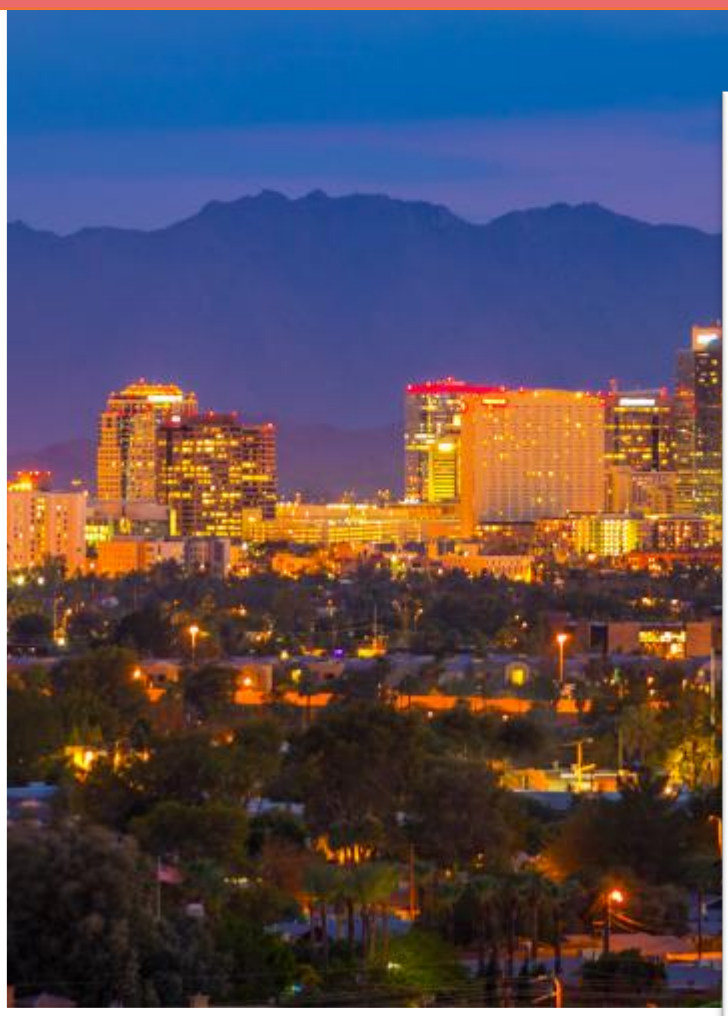
Heat-Associated Deaths in Maricopa County, AZ
Final Report for 2020



Photograph by Dan Sorensen:
http://www.dansorensenphotography.com/

Maricopa County Public Health
WeArePublicHealth.org

Acknowledgements

The Maricopa County Department of Public Health (MCDPH), Office of Epidemiology would like to thank the following agencies for their contributions to this report:

- Maricopa County Office of the Medical Examiner (OME)
- Maricopa County Office of Vital Registration (OVR)
- Arizona Department of Health Services (ADHS), Office of Vital Registration
- National Weather Service (NWS)
- Maricopa Association of Governments (MAG)
- Local hospitals (infection preventionists, emergency departments, social worker staff)
- City of Phoenix Heat Relief Network

To receive additional data, please submit a data request form through the Maricopa County Public Health website here. A staff member from the Climate and Health team will contact you to discuss your request.

You may also contact the Climate and Health Team through email:

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Introduction

Mortality from environmental heat is a significant public health problem in Maricopa County, especially because it is largely preventable. Maricopa County has conducted heat surveillance since 2006. Each year, the enhanced heat surveillance season usually begins in May and ends in October. The main goals of heat surveillance are to identify the demographic characteristics of heat-associated deaths (e.g., age and gender) and the risk factors for mortality (e.g., homelessness). Sharing this information helps community stakeholders to design interventions to prevent heat-associated deaths among vulnerable populations.

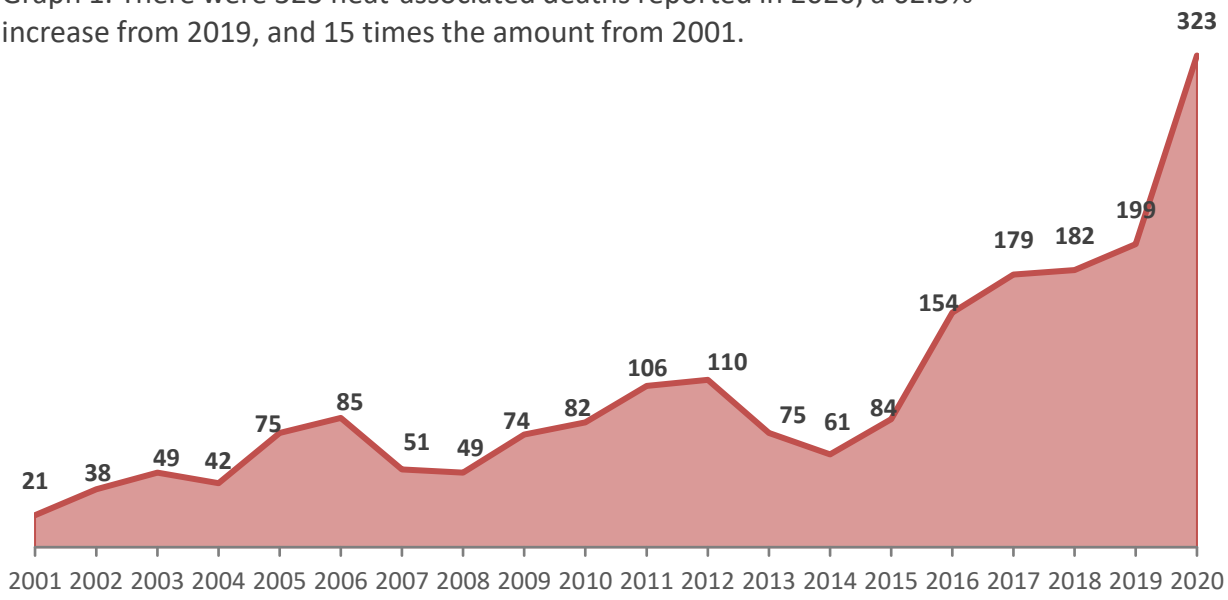
The two main sources of data for heat surveillance are: preliminary reports of death (PRODs) from the Office of the Medical Examiner (OME) and death certificates from the MCDPH Office of Vital Registration.

Heat-associated deaths are classified as heat caused or heat-related. Heat caused deaths are those in which environmental heat was directly involved in the sequence of events causing deaths. Heat-related deaths are those in which environmental heat contributed to the deaths but was not in the sequence of events causing these deaths. For more information on how heat-associated deaths are classified, see the definitions in Appendix. For more information on MCDPH's surveillance system, see Background and Methodology.

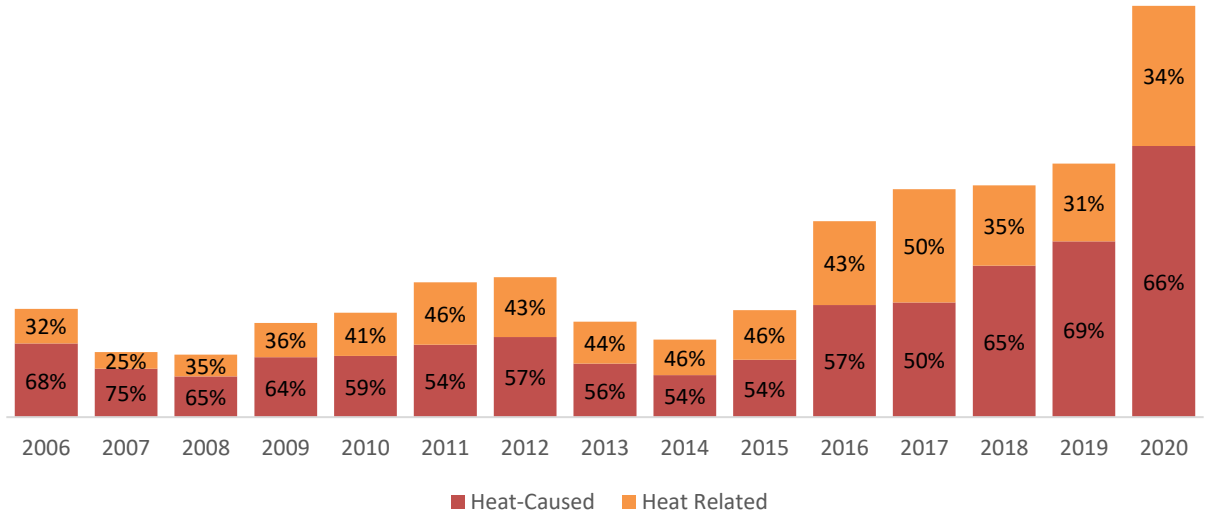
Results

Heat-Associated Deaths by Year

Graph 1. There were 323 heat-associated deaths reported in 2020, a 62.3% increase from 2019, and 15 times the amount from 2001.



Graph 2. Sixty-one percent of heat-associated deaths since 2006 have been classified as heat caused.



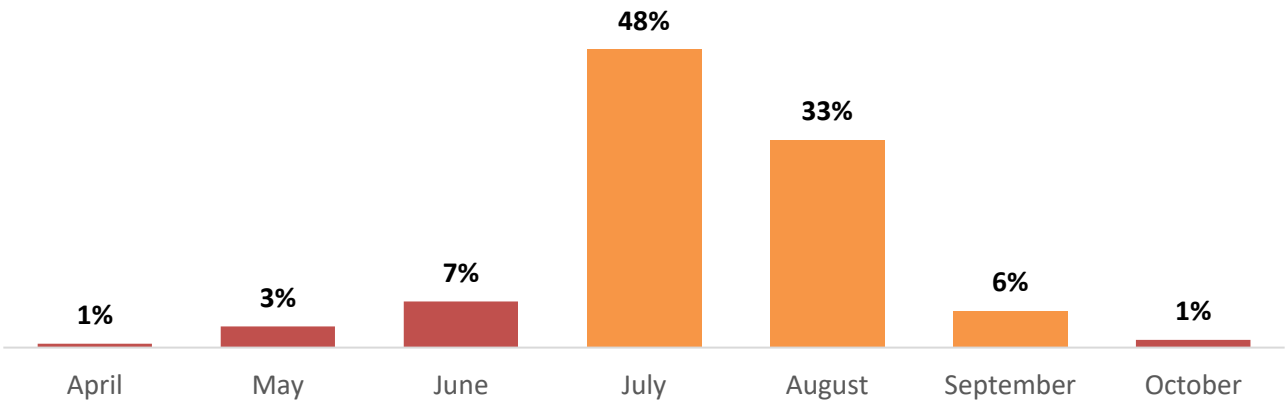
*Data Sources: Maricopa County, Office of Vital Registration and Office of Medical Examiner; Arizona Department of Health Services, Office of Vital Registration.

**See Methodology in the Appendix for more information about the number of confirmed, ruled-out, and pending cases by year.

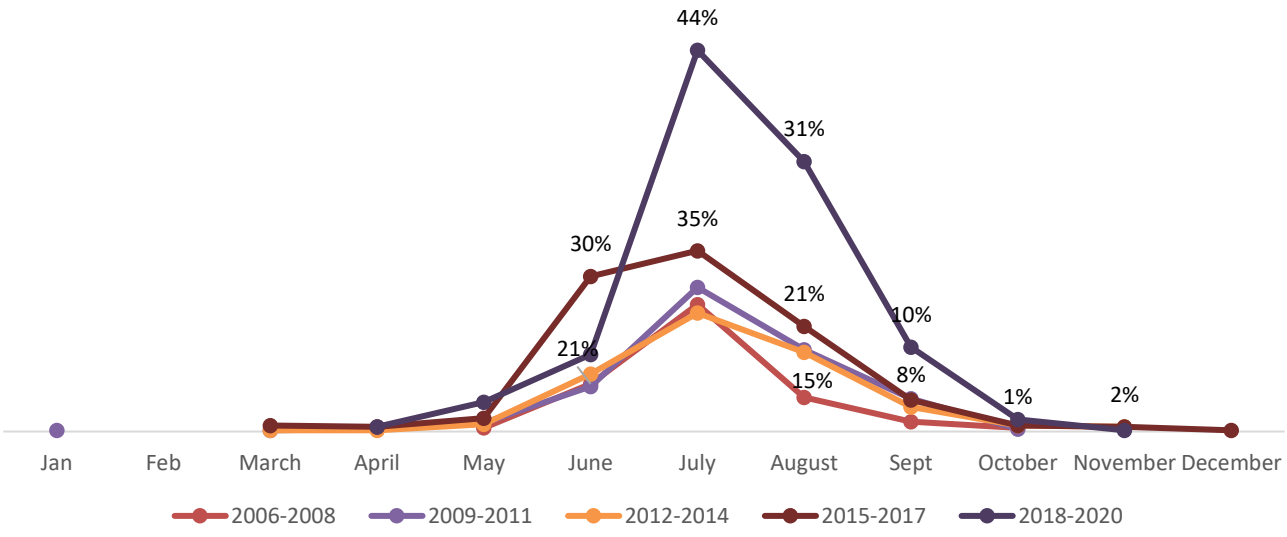
Heat-Associated Deaths by Month

- The months with the greatest number of deaths have been migrating to later in the year over time. June and July had been the months with the greatest number of deaths in 2013, while July and August are more prominent in 2020.

Graph 3. Eighty-seven percent of all heat associated deaths occurred in the months of July, August, and September (N=323).



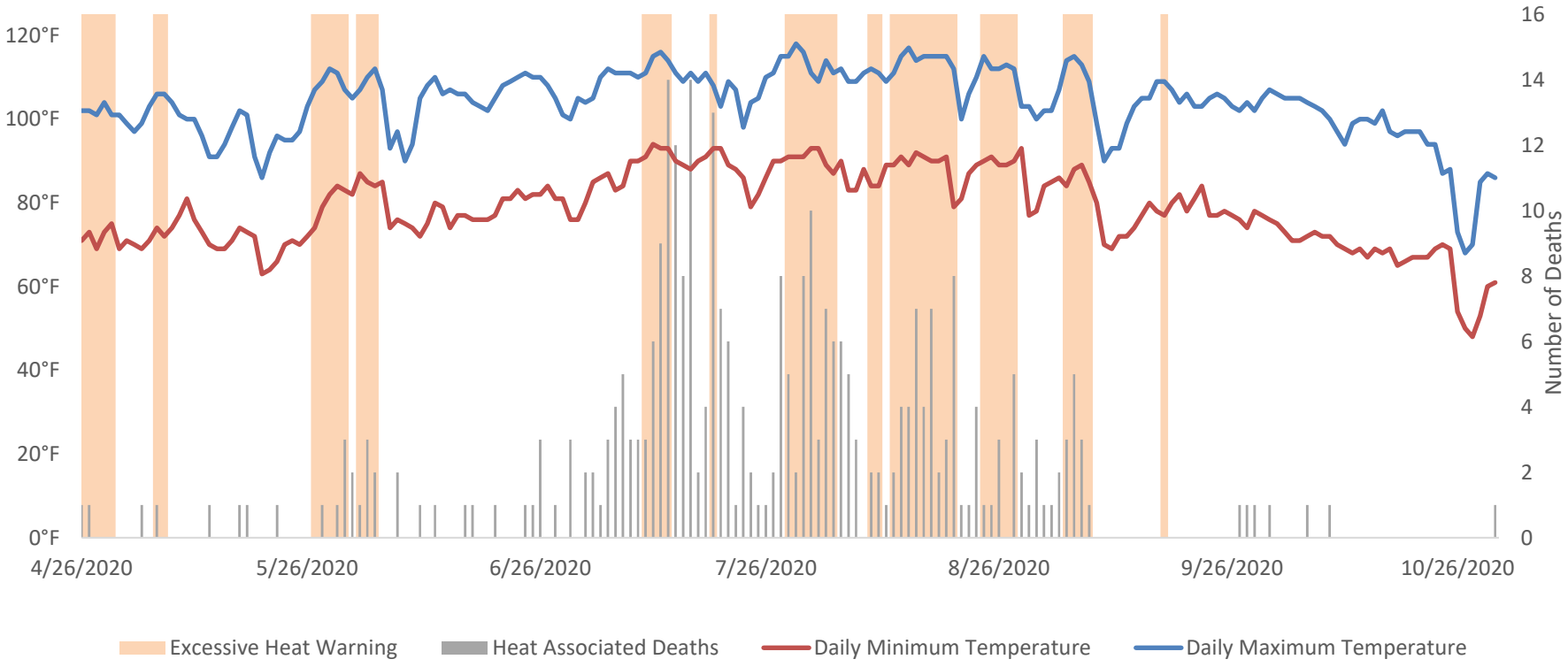
Graph 4. Heat associated deaths have been migrating, occurring more often in the second half of the year.



Heat-Associated Deaths and Temperatures.

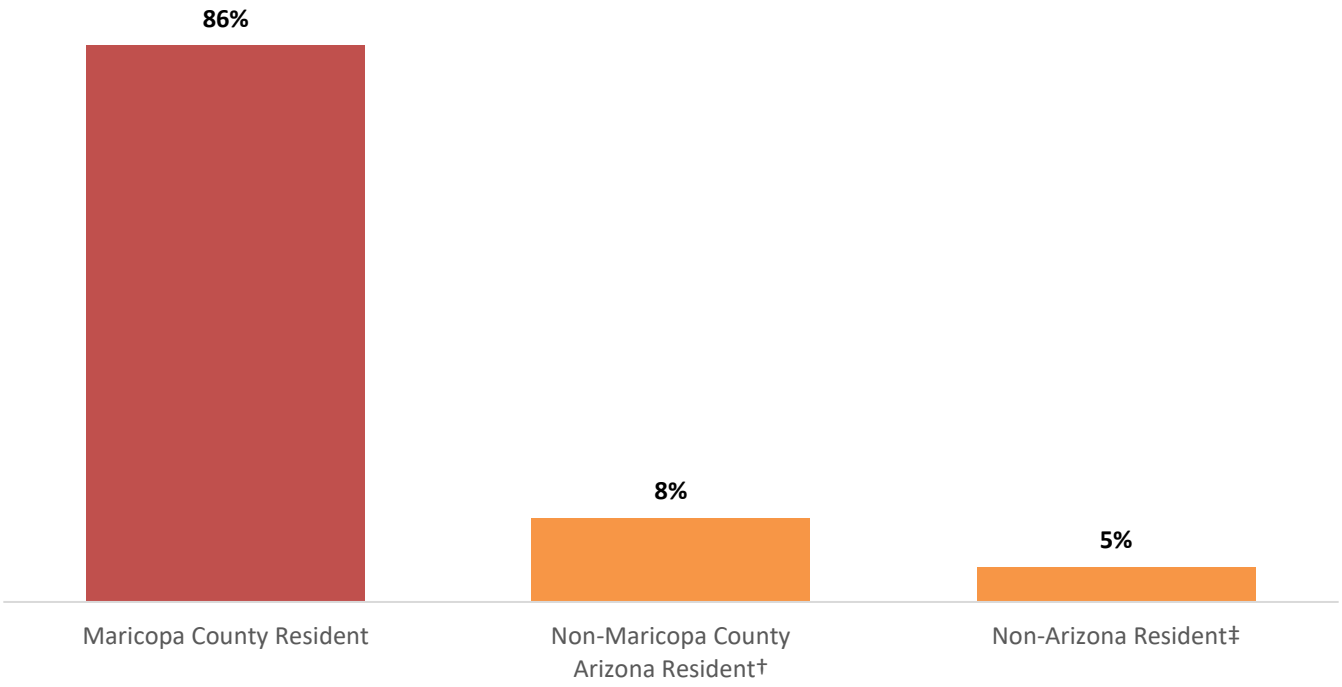
- In 2020, the National Weather Service issued twelve excessive heat warnings for a total of 48 days. The average number of heat warnings for the past 5 years (2015-2019) is 5 lasting for a total of 17 days.
- The highest daily temperature this year (2020) occurred on July 30th and was 118°F, 2 deaths occurred on this day. The average highest daily temperature for the past 5 years (2015-2019) is 117°F. The highest daily temperatures ranged from 115°F to 119°F.
- For the past 5 years (2015-2019), an average of 23% of heat-associated deaths occurred on days for which an excessive heat warning had been issued. Last year (2019), 34% of heat-associated deaths occurred on days for which an excessive heat warning had been issued.

Graph 5. Fifty-two percent of heat-associated deaths occurred on days for which an excessive heat warning has been issued. (N=167).



Heat-Associated Deaths by Residency

Graph 6. Maricopa County residents accounted for 86% of all heat-associated deaths among cases with known county of residence.

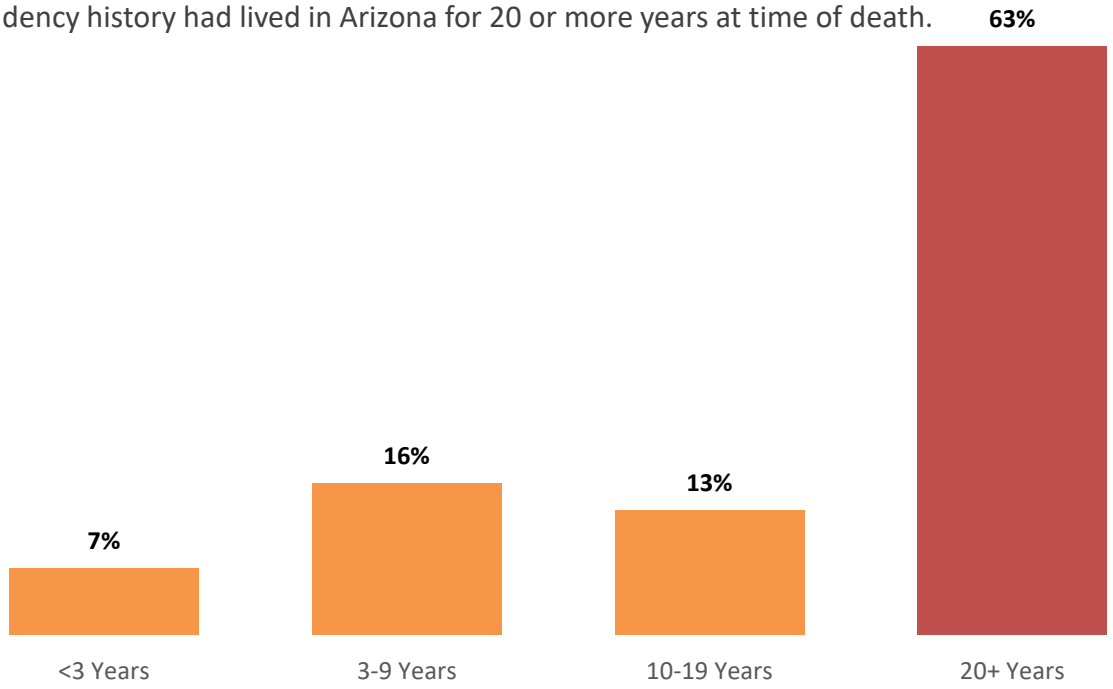


† Non-Maricopa County Arizona Resident cases include residents from Apache, Coconino, Gila, Graham, Mohave, Navajo, Pima, Pinal, Yavapai, and Yuma Counties and cases of unknown county residency in Arizona.

‡ Non-Arizona Resident cases include residents of Alaska, California, Louisiana, Maryland, Michigan, Missouri, Nayarit, New Mexico, Ohio, Oregon, Pennsylvania, Texas, and Utah.

* 16 cases have an unknown residency state or county.

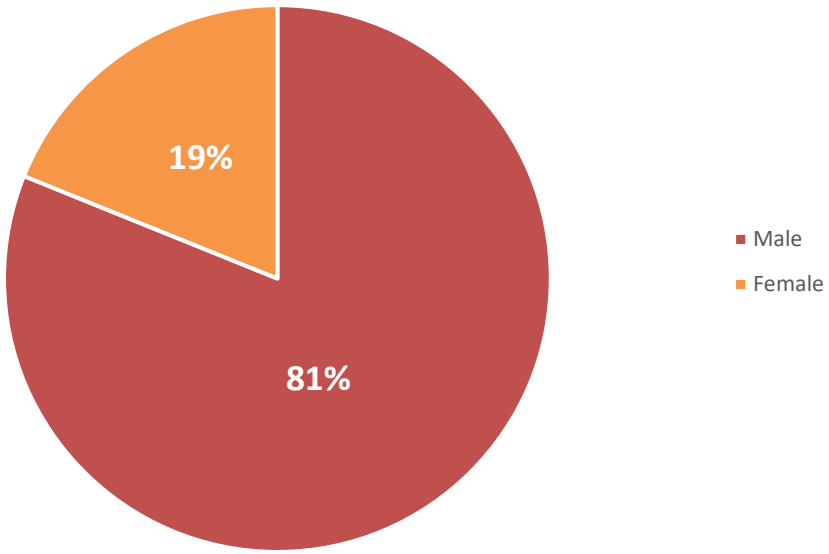
Graph 7. Sixty-three percent of heat-associated deaths with Arizona residency history had lived in Arizona for 20 or more years at time of death.



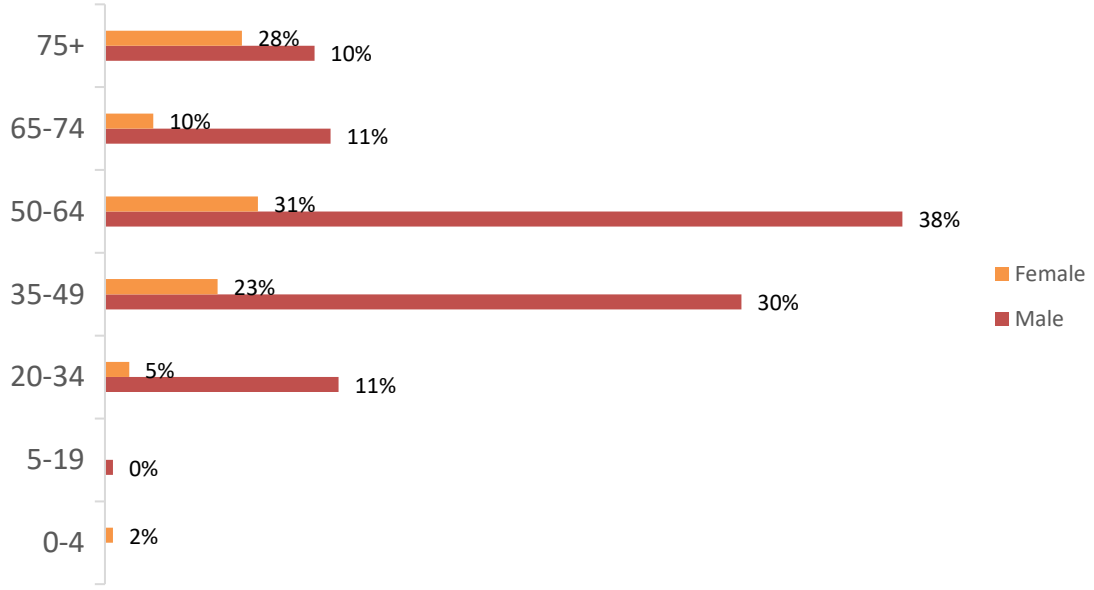
*Seventy-two cases for which time spent in Arizona was unknown were excluded from analysis.

Demographic Characteristics of Heat-Associated Deaths

Graph 8. Males made up 81% of all heat associated deaths.

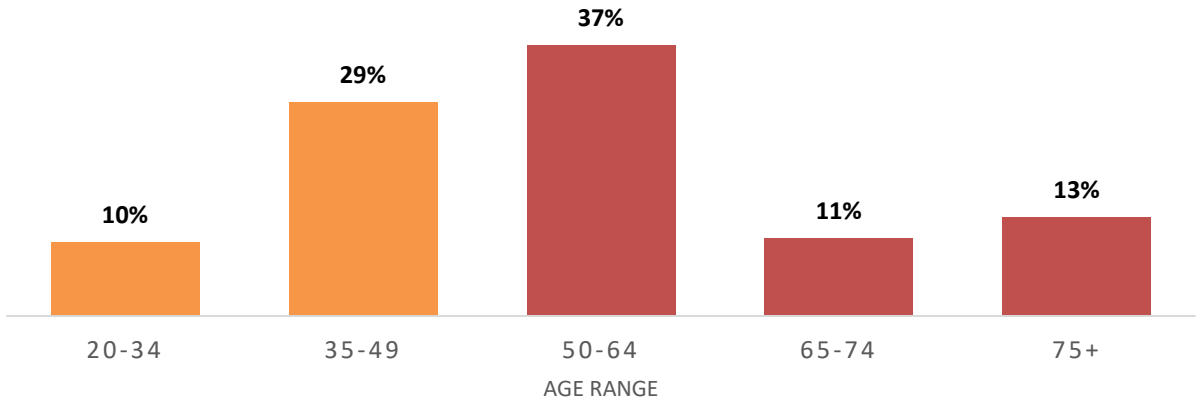


Graph 9. Males saw the highest number of heat associated deaths across all age groups, except children ages 0-4.



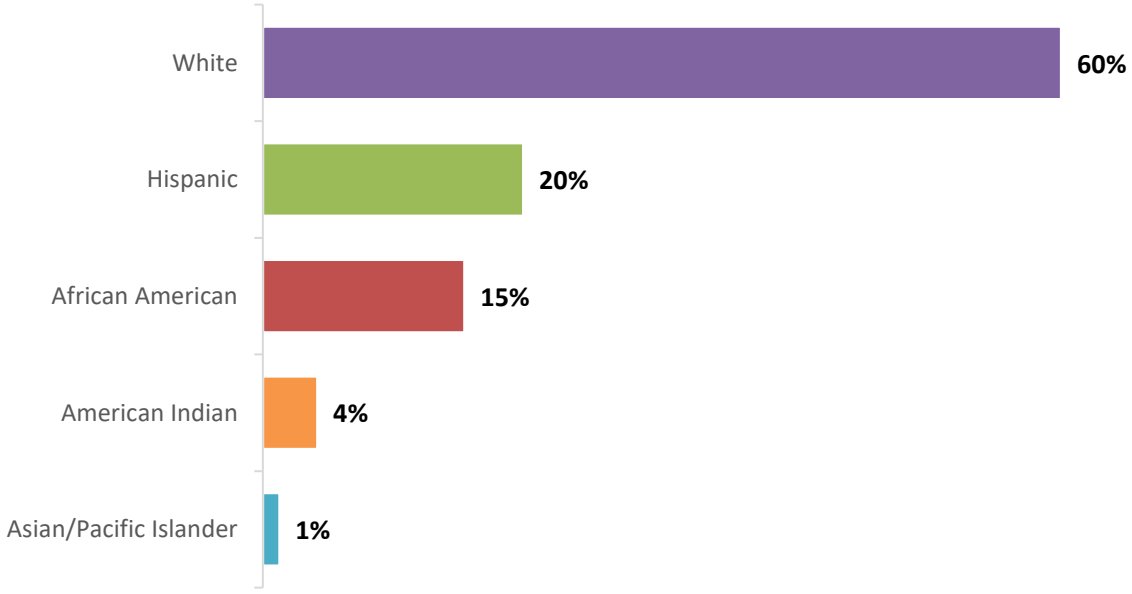
*See Appendix 3 for more detailed information on youth heat-associated deaths

Graph 10. Sixty-one percent of heat-associated deaths were among those 50 and older.



* The ages for one case was unknown.
** Children ages 0-19 made up <%1 of the total data and were excluded from this graph.
***See Appendix 3 for more detailed information on youth heat-associated deaths

Graph 11. Blacks and American Indians are disproportionately represented among heat-associated deaths.

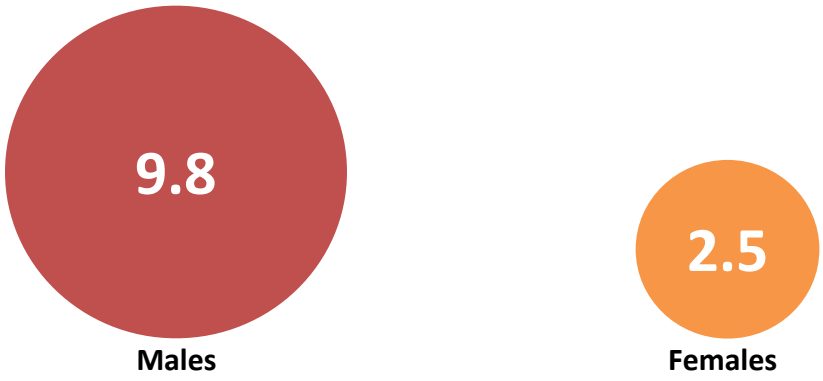


*Six cases for which race, and ethnicity was unknown were excluded from analysis
**See Appendix 3 for more detailed information on African American, Hispanic, and American Indian heat-associated deaths

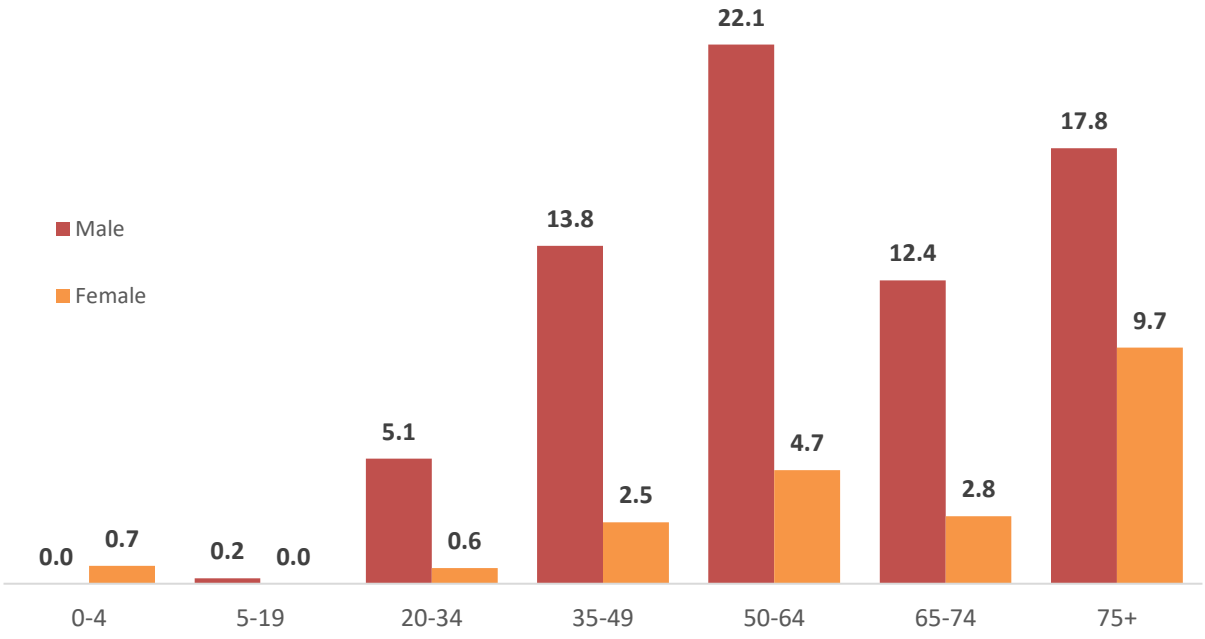
Heat-Associated Death Rates

- Death rate graphs below include rates per 100,000 residents. Rates calculated using census population estimates for 2019.

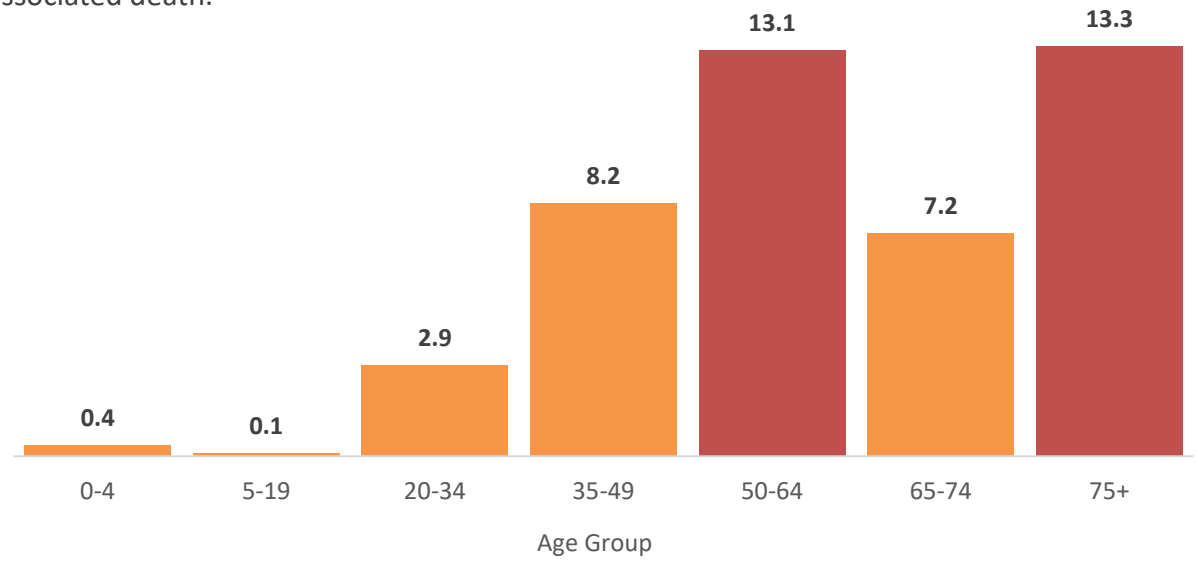
Graph 12. The heat-associated death rate for males was more than three times greater than the rate for females.



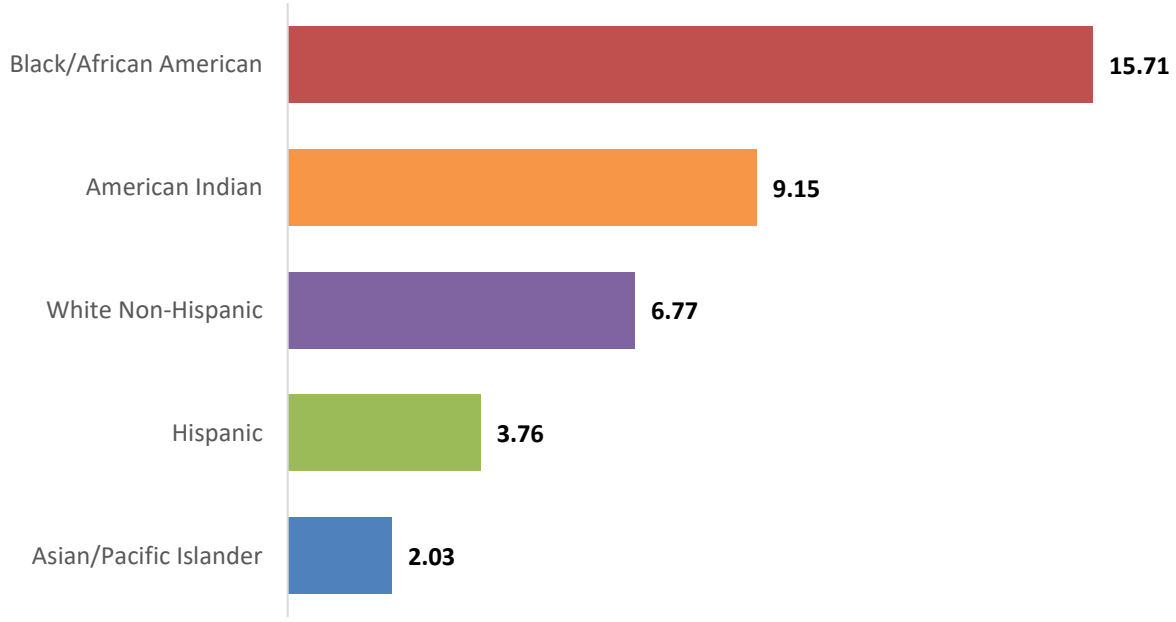
Graph 13. For males, the heat-associated death rate was highest in the 50-64 age group. For females, the heat-associated death rate was highest in the 75+ year age group.



Graph 14. Those aged 50-64 and 75+ had the highest rates of heat-associated death.



Graph 15. African Americans and American Indians had the highest rates of heat-associated deaths per 100,000 residents.



*See Appendix 3 for more detailed information on African American, Hispanic, and American Indian heat-associated deaths.

Heat-Associated Deaths by Place of Injury

Table 1. Top 3 cities in Maricopa County with the highest number of deaths

City	Number of Deaths	Rate per 100,000
Phoenix	191	12
Tempe	17	9
Mesa	26	5

*Rates based on US Census Bureau 2019 Population Rate by City

Graph 16. Of the deaths where the ZIP code for place of injury is known (N=305), the ZIP codes **85034, 85337, 85004, 85007, and 85320** had the highest rates of heat-associated deaths per 100,000 residents.

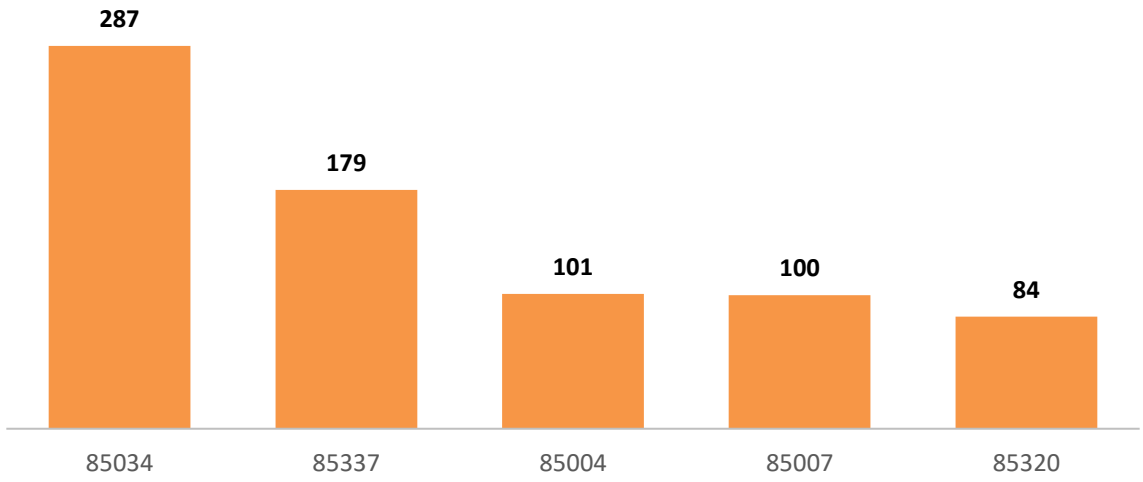
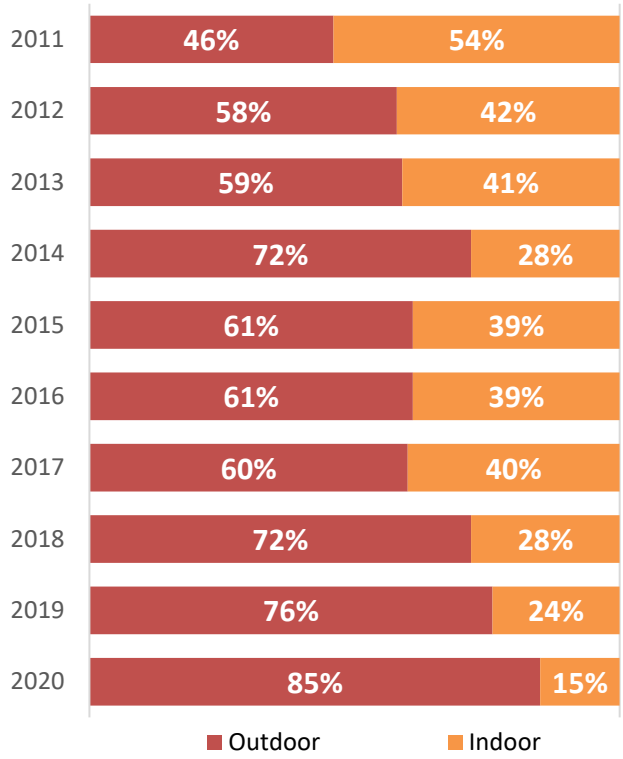


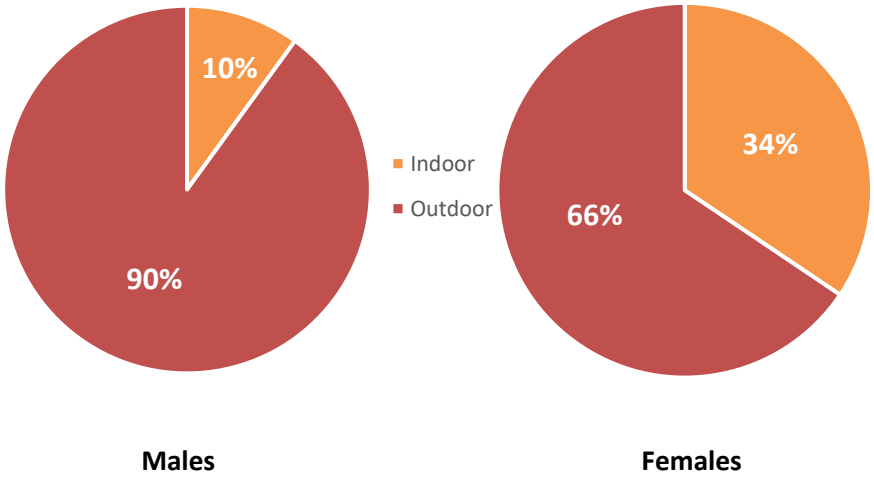
Table 2. Top 5 ZIP codes in Maricopa County with the highest rates of deaths

Zip Code	Number of Deaths	Rate per 100,000
85034 (Phoenix)	16	287
85377 (Carefree)	5	179
85004 (Phoenix)	1	101
85007 (Phoenix)	5	100
85320 (Aguila)	14	84

Graph 17. A greater proportion of injuries that lead to deaths occurred outdoors than in previous years.

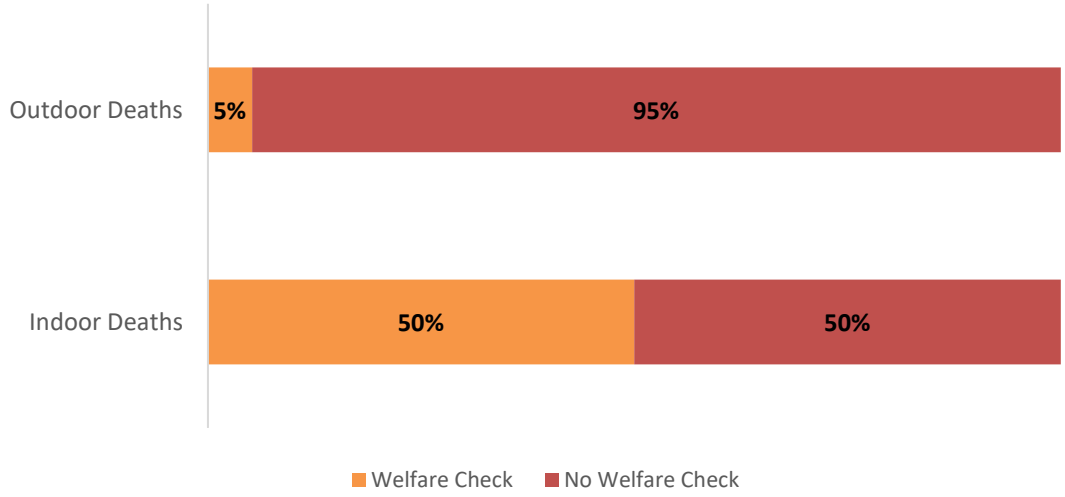


Graph 18. A higher proportion of male injuries than female injuries occurred outdoors.



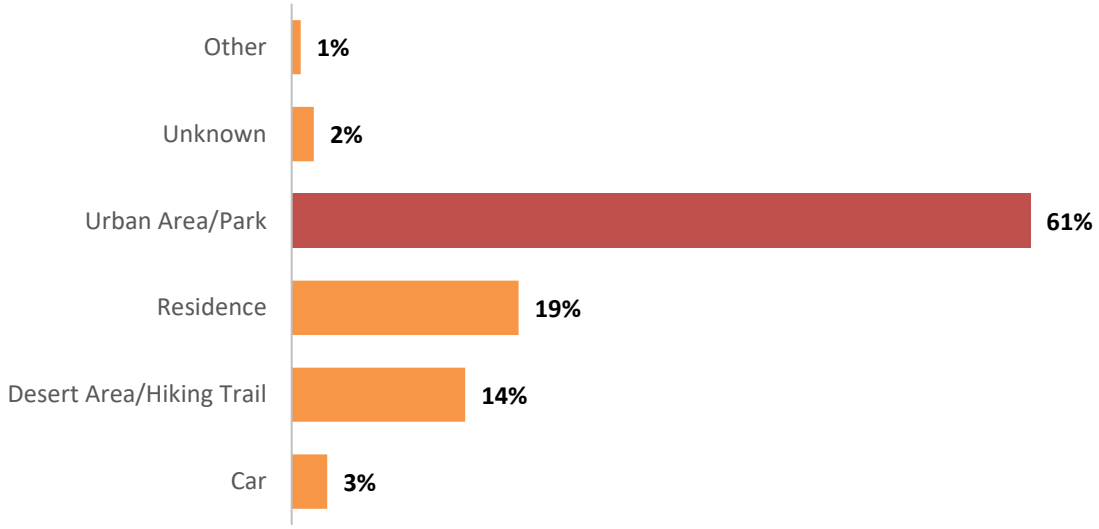
*See appendix 3 for more detailed information on male/female indoor and male outdoor heat-associated deaths.

Graph 19. Fifty percent of indoor deaths were found during a welfare check compared to five percent of outdoor deaths.



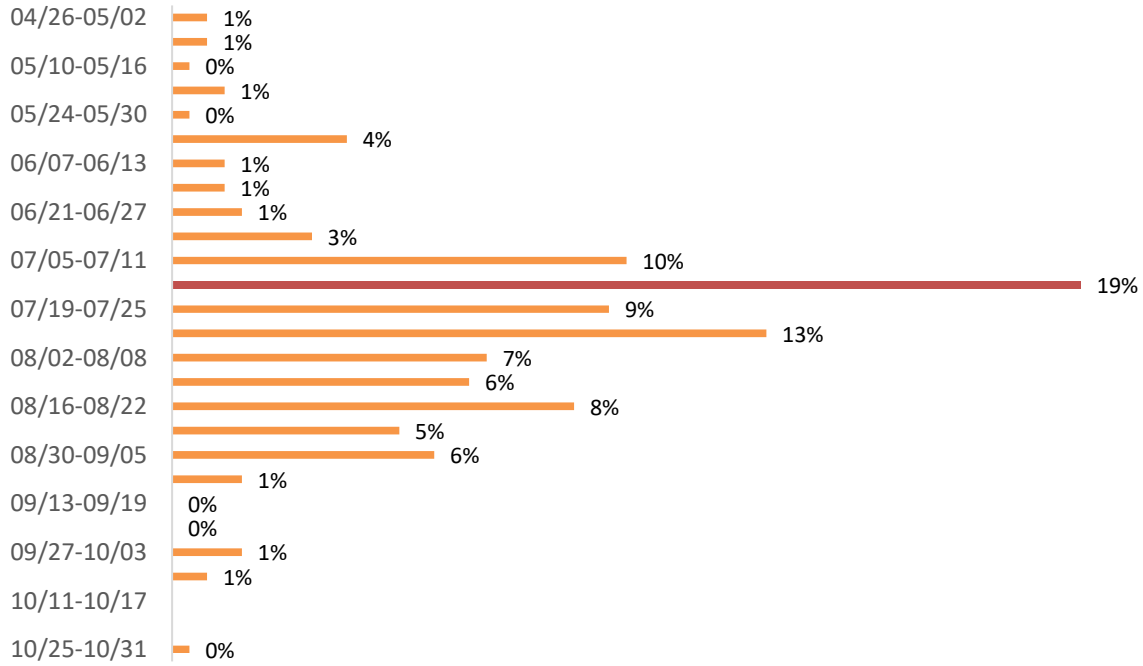
Outdoor Deaths

Graph 20. Sixty-one percent of outdoor injuries with a known location of injury occurred in an urban area.

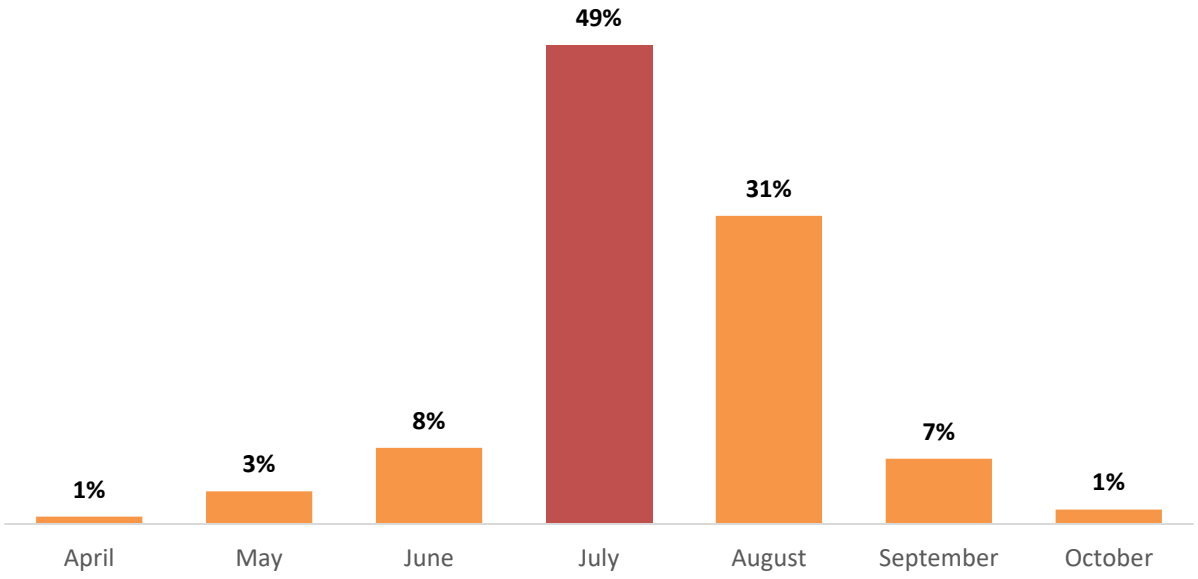


*9 total cases have an unknown indoor/outdoor place of injury
** See appendix 3 for more detailed information on heat-associated car deaths.

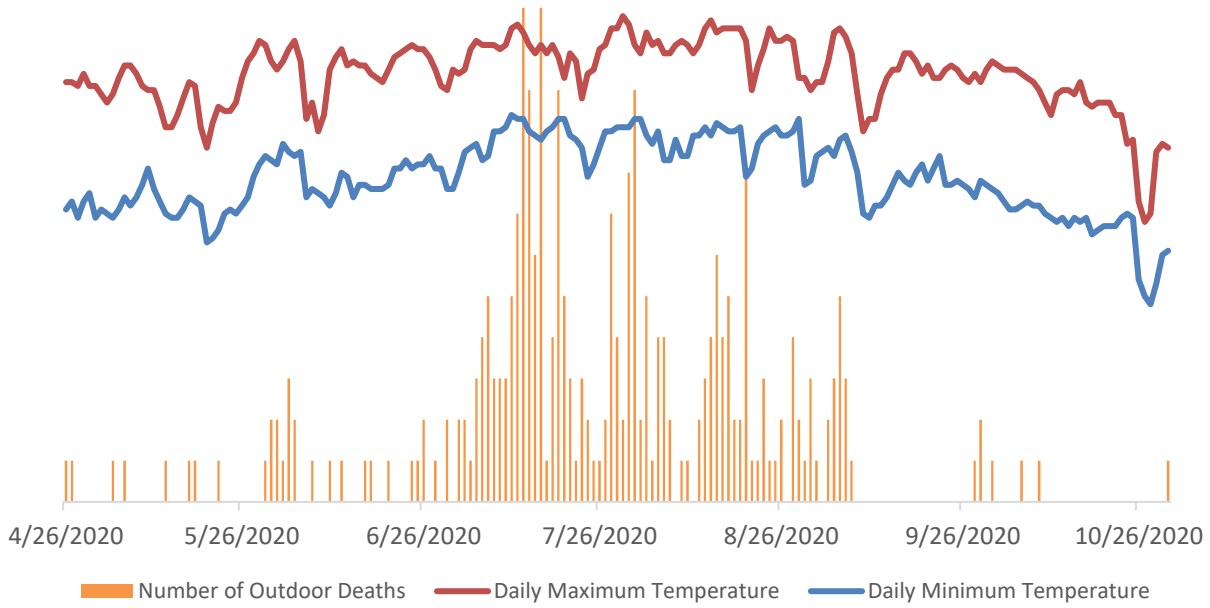
Graph 21. The greatest number of outdoor deaths happened in the 2nd week of July.



Graph 22. Outdoor heat associated deaths occurred most often in July.

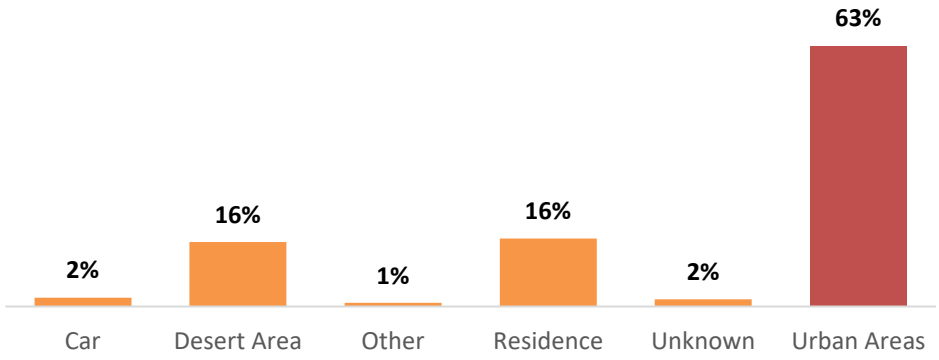


Graph 23. The average high air temperature for outdoor heat associated deaths was 108 degrees.



Male Outdoor Death Demographics

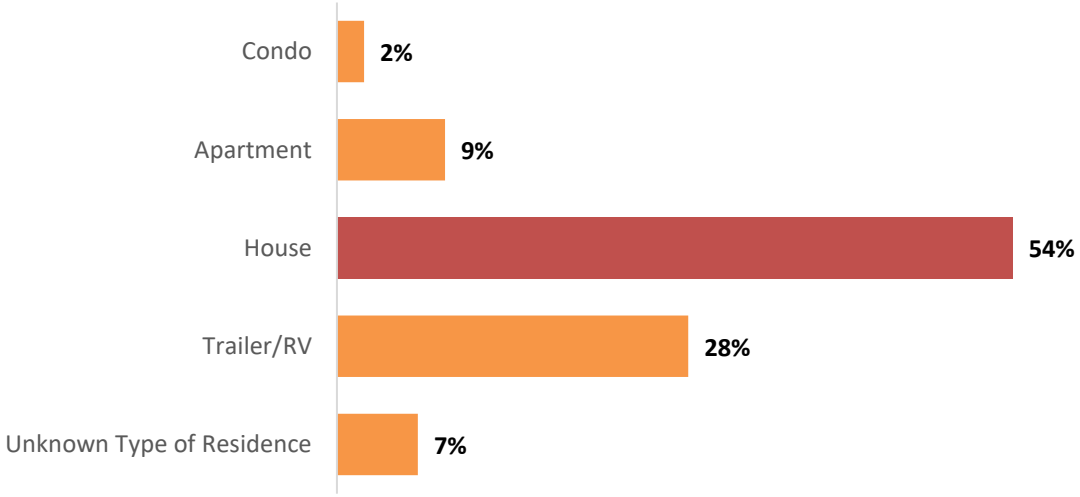
Graph 24. Sixty-three percent of outdoor male deaths occurred in an urban area.



- Eighty-five percent of outdoor deaths were male.
- Sixty-seven percent of male outdoor deaths were homeless.
- Seventy-five percent of homeless males died in an urban area.
- Thirty-seven percent of all male outdoor deaths were aged 50-64.
- Fifty-six percent of all male outdoor deaths identified as White/Non-Hispanic.

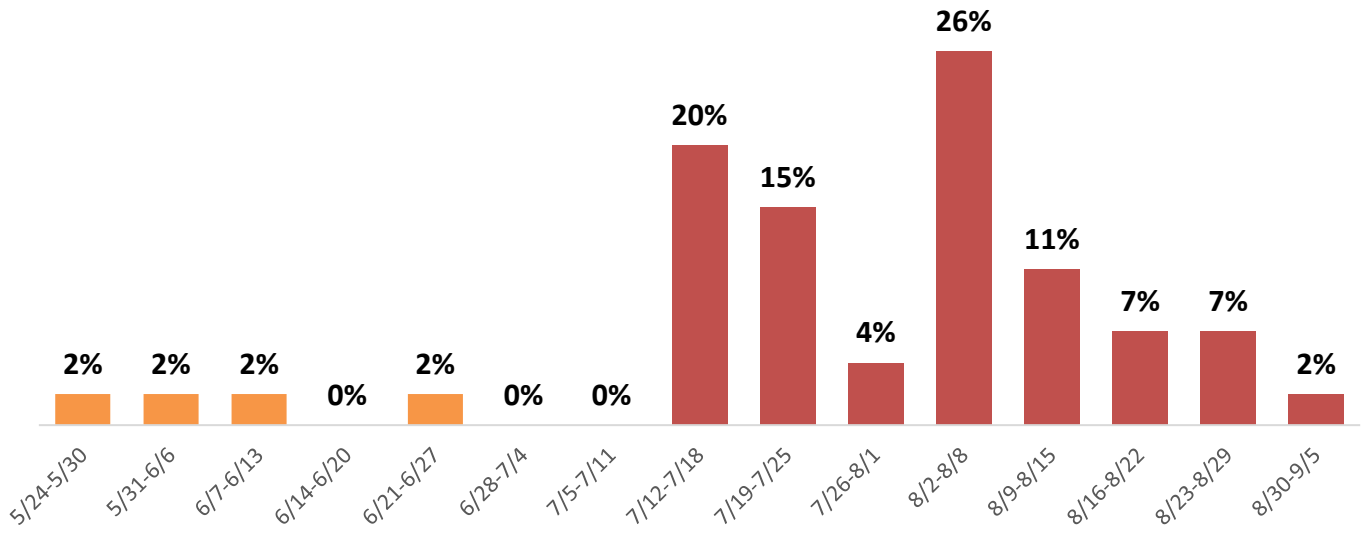
Indoor Deaths

Graph 25. Twenty-eight percent of indoor heat-associated deaths occurred in a trailer/RV.

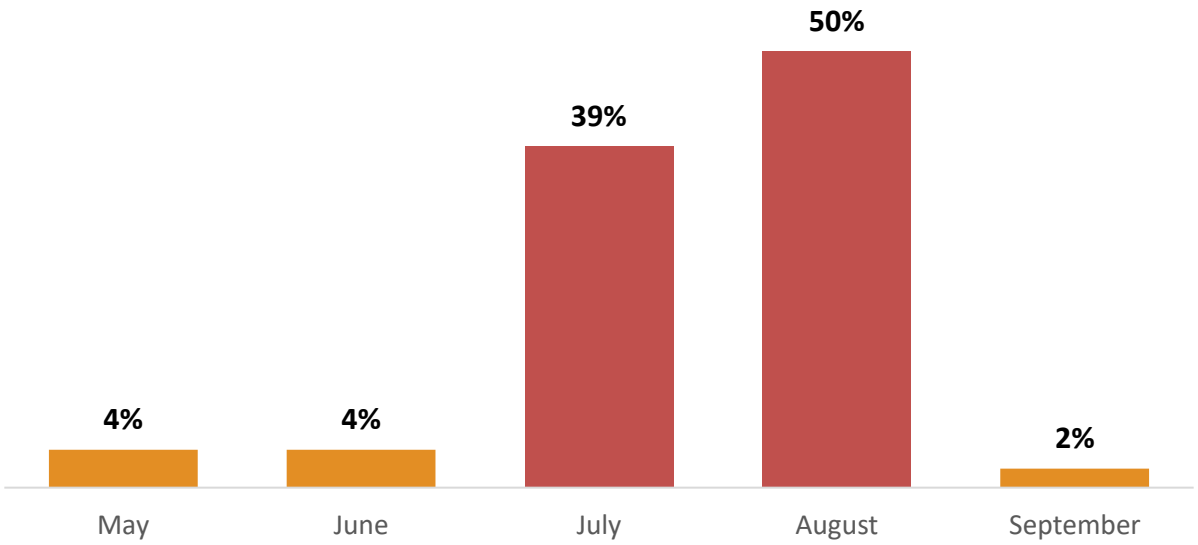


*9 total cases have an unknown indoor/outdoor place of injury
**Unknown Type of Residence is defined as an unspecified living space.
***See Appendix 3 for more detailed information on mobile home heat-associated deaths.

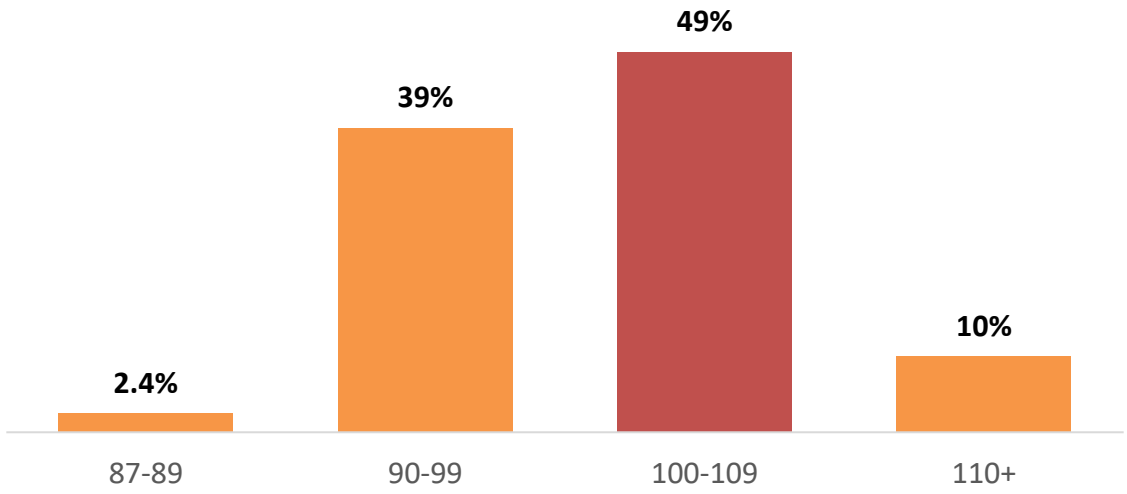
Graph 26. The majority (92%) of indoor heat deaths occurred during the months of July and August.



Graph 27. Indoor heat associated deaths occur from May to September.



Graph 28. Indoor heat-associated deaths can occur at temperatures as low as 87 degrees.

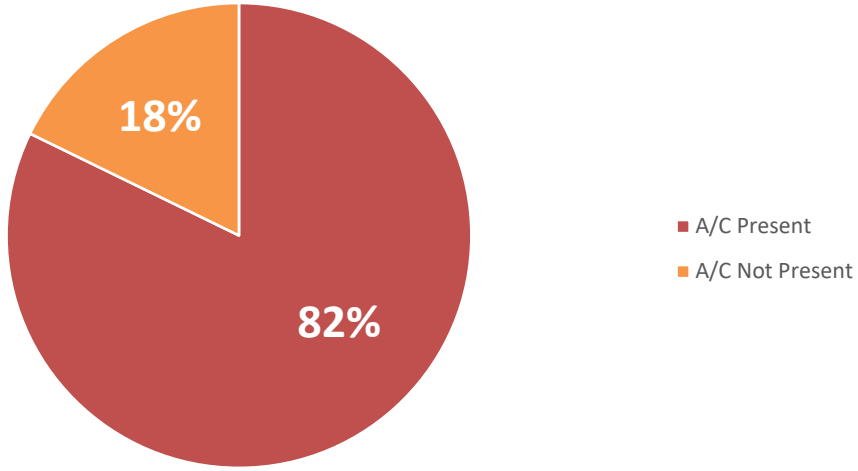


*See appendix 3 for more detailed information on male/female indoor and male outdoor heat-associated deaths.

Air Conditioning Use for Indoor Injuries

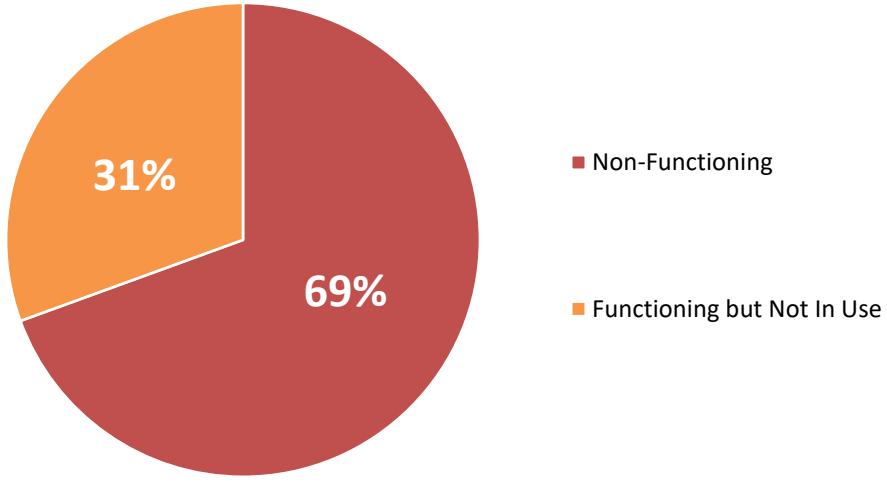
*Evaporative coolers were not considered as A/C units as their ability to cool becomes inadequate in extreme Maricopa County temperatures.

Graph 29. Eighty-two percent of indoor deaths had an air conditioning unit present at time of death.



*1 unknown case

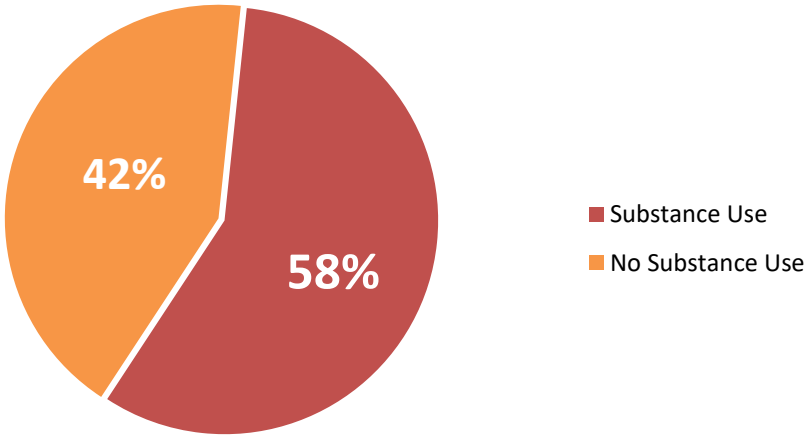
Graph 30. Among deaths where an A/C unit was present, a non-functioning A/C unit was the most common reason for not having a cooled environment at the time of death.



*In past years there has been a category for individuals who did not have electricity as a reason for having no air conditioning. No individuals fall into this category for 2020, possibly due to the Electric Utility Relief Package put in place during the COVID-19 pandemic.

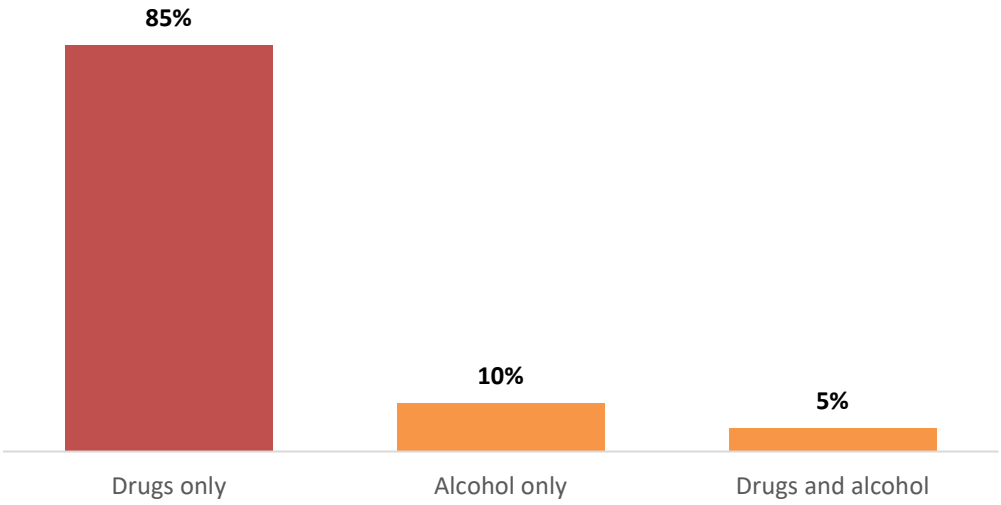
Substance Use among Heat-Associated Deaths

Graph 31. Fifty-eight percent of all cases involved substance use as a cause of death or a contributing factor.



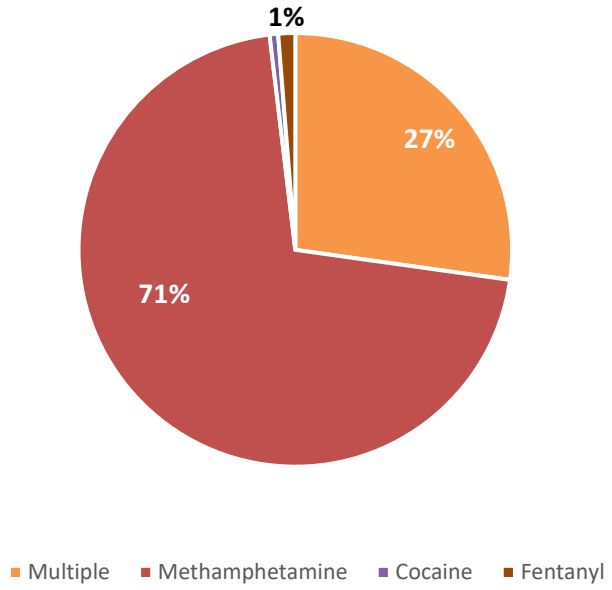
*See Appendix 3 for more detailed information on substance use heat-associated deaths.

Graph 32. In eighty-five percent of cases that involved substance use, drug use was listed as either a cause of death or a contributing factor.

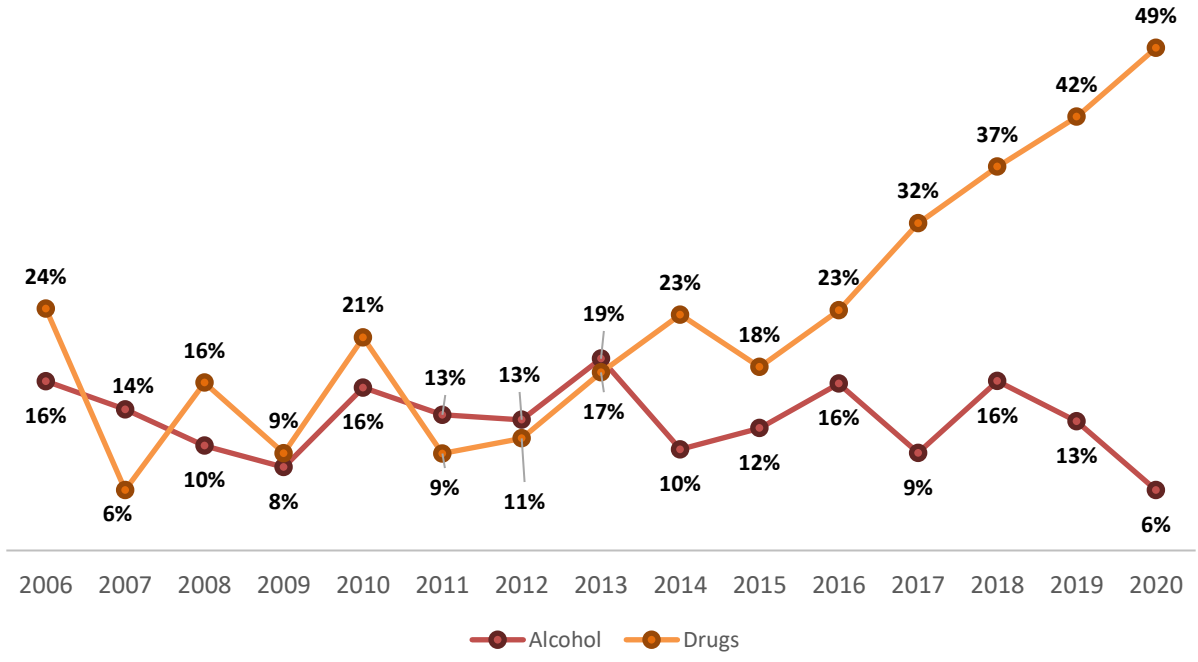


*Types of drugs included in multiple drug toxicity cases include: Methamphetamine, Oxycodone, Fentanyl, Citalopram, Opioids, Benzodiazepines, Lorazepam, Morphine, Hydroxyzine, Aripiprazole, Oxymorphone, Gabapentin, Cyclobenzaprine, Diphenhydramine, and Carisoprodol.

Graph 33. Of the heat related deaths where drugs were involved (N=158), 71% involved methamphetamine toxicity.

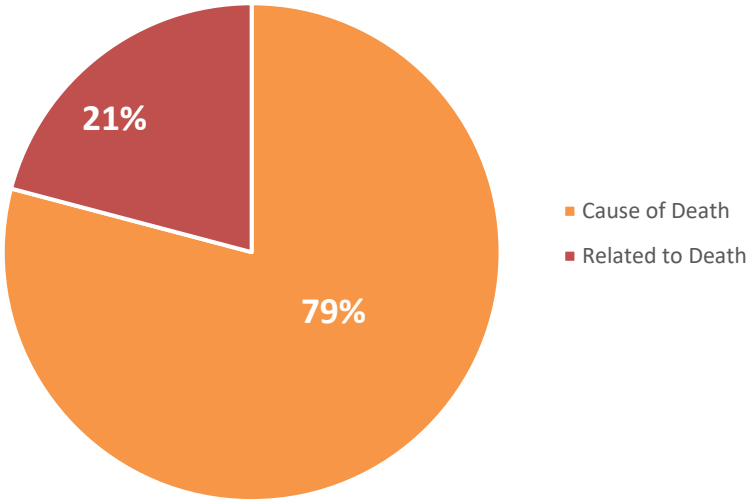


Graph 34. The proportion of heat-associated deaths involving drug use increased by seven percent from the previous year.*



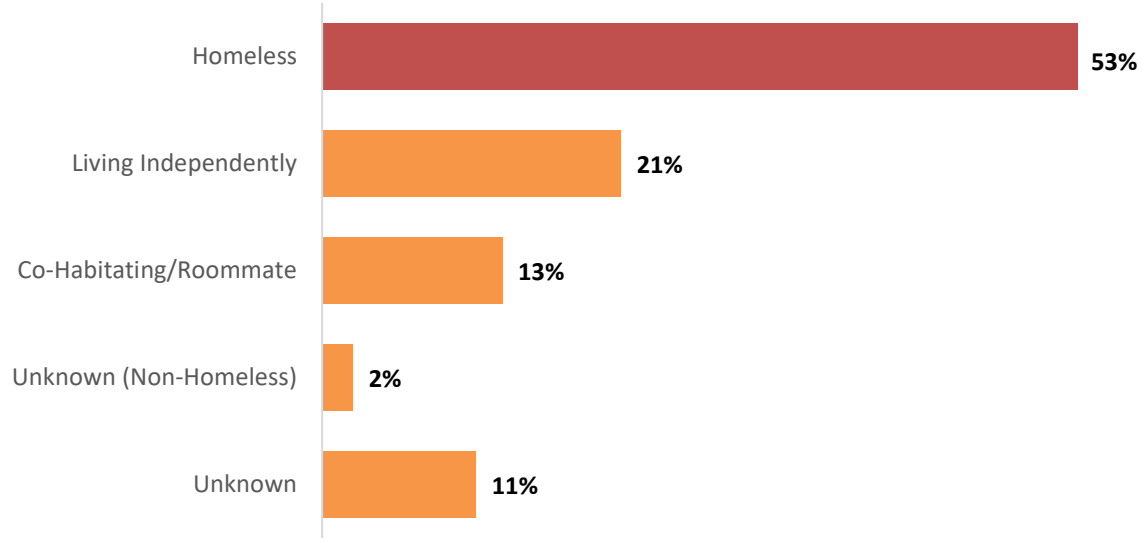
*Cases involving both drug and alcohol use are represented uniquely on each line.

Graph 35. Of the heat related deaths where drugs were involved (N=158), 79% of the time drugs were a primary cause of death.

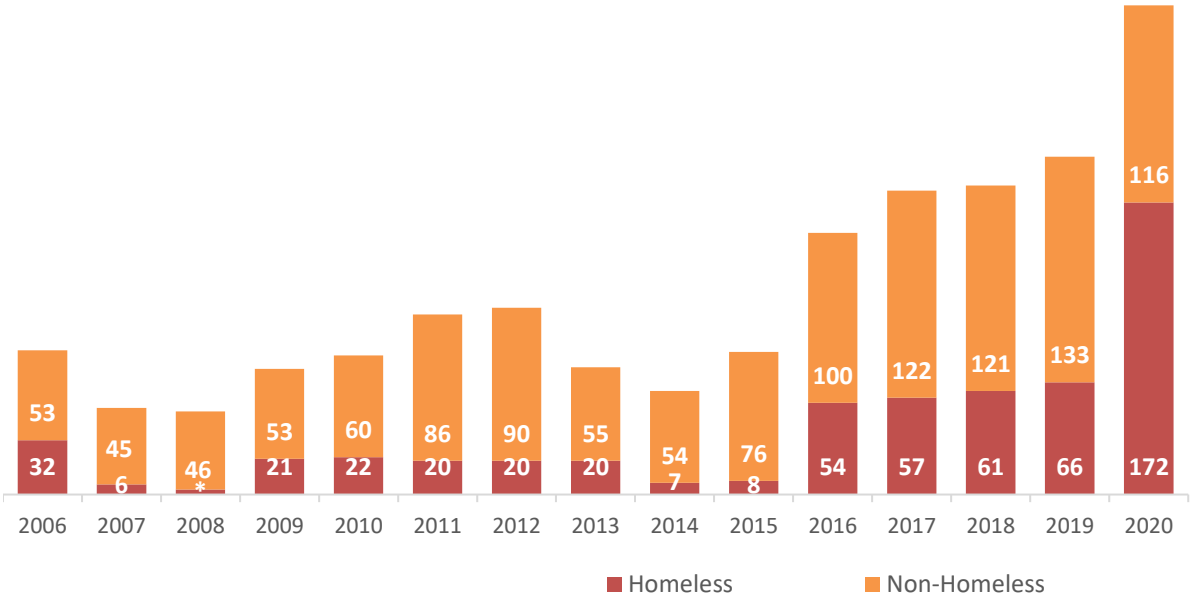


Living Situation among Heat-Associated Deaths

Graph 36. Fifty-three percent of cases were homeless at time of death.



Graph 37. The number of heat associated deaths among the homeless population more than doubled from 2019 to 2020.



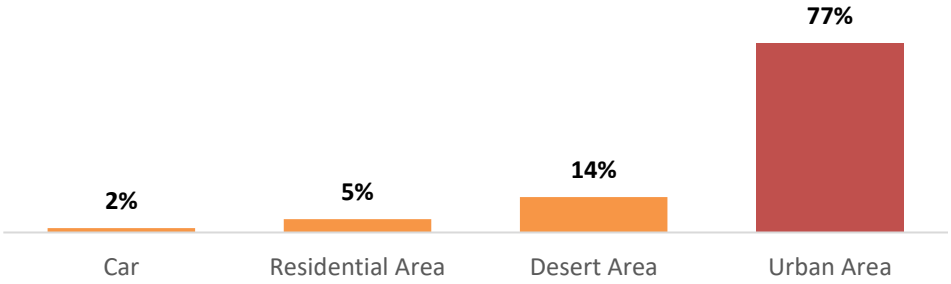
*34 cases where living situation was unknown were excluded from graph.

**5 homeless heat-associated deaths had an unknown county of residence.

***See Appendix 3 for more detailed information on homeless heat-associated deaths.

Homeless Outdoor Death Demographics

Graph 38. Seventy-seven percent of homeless outdoor deaths occurred in an urban area.



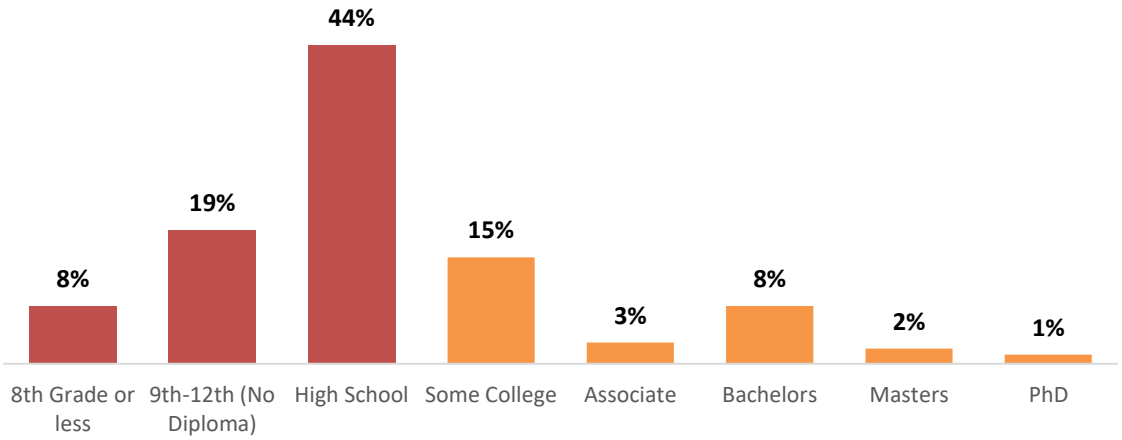
- Sixty-two percent of outdoor deaths were homeless.
- Ninety-seven percent of homeless deaths occurred outdoors.
- Seventy-seven percent of homeless outdoor deaths died in an urban area.
- Ninety-two percent of homeless outdoor deaths were male.
- Forty percent of homeless outdoor deaths were among 50-64 year olds.
- Fifty-six percent of homeless outdoor deaths were among White Non-Hispanics; 20% were among Hispanics; and 17% were among Blacks.

Education and Heat-Associated Deaths

*83 cases have an unknown level of education

**Only adults aged ≥20 were included in these results.

Graph 39. Heat-associated deaths occur in individuals with all levels of education.

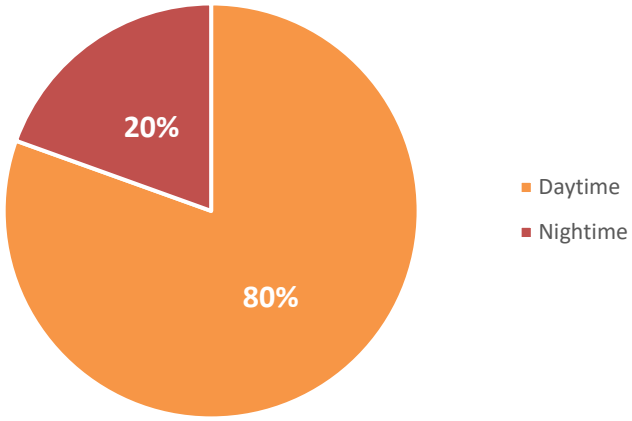


Time of Day and Heat-Associated Deaths

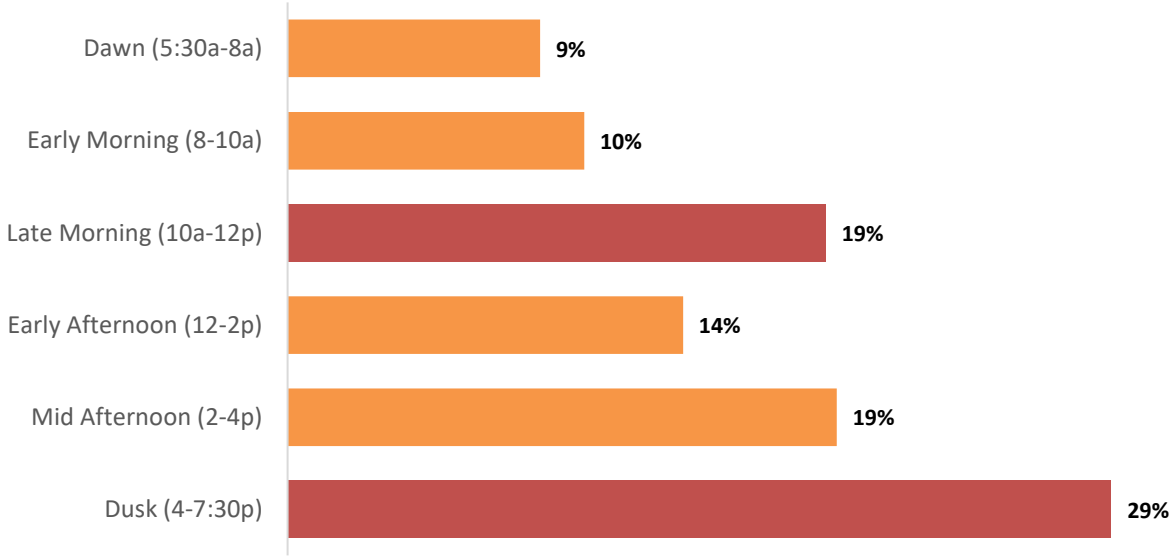
*Day time is considered after sunrise (5:30a) and before sunset (7:30p)

*Nighttime is considered after sunset and before sunrise

Graph 40. Eighty percent of all heat associated deaths occured during daytime hours.



Graph 41. The number of deaths during day time hours is highest from 4p to 7:30p.



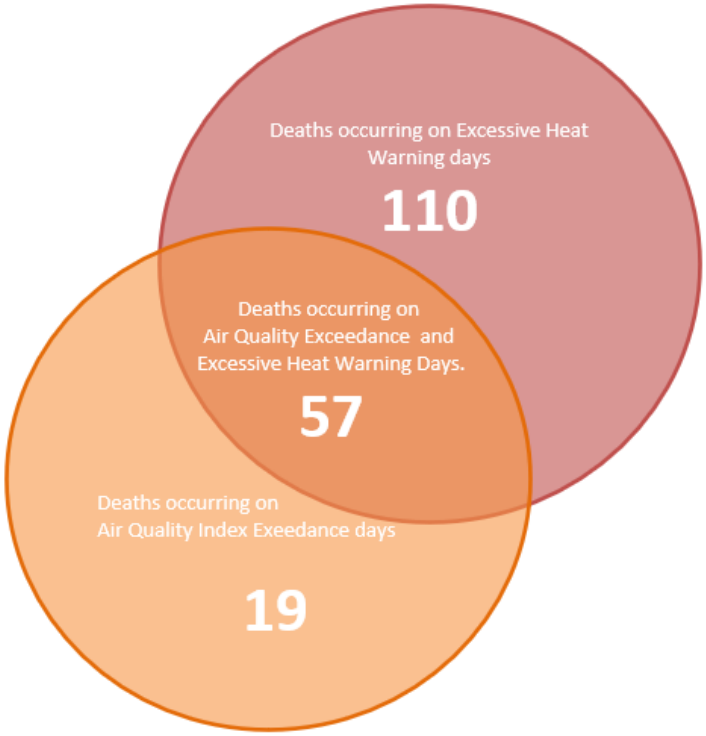
Air Quality Index and Heat-Associated Deaths

There was a total of 150 Moderate Air Quality days and 40 Exceedance Air Quality days.

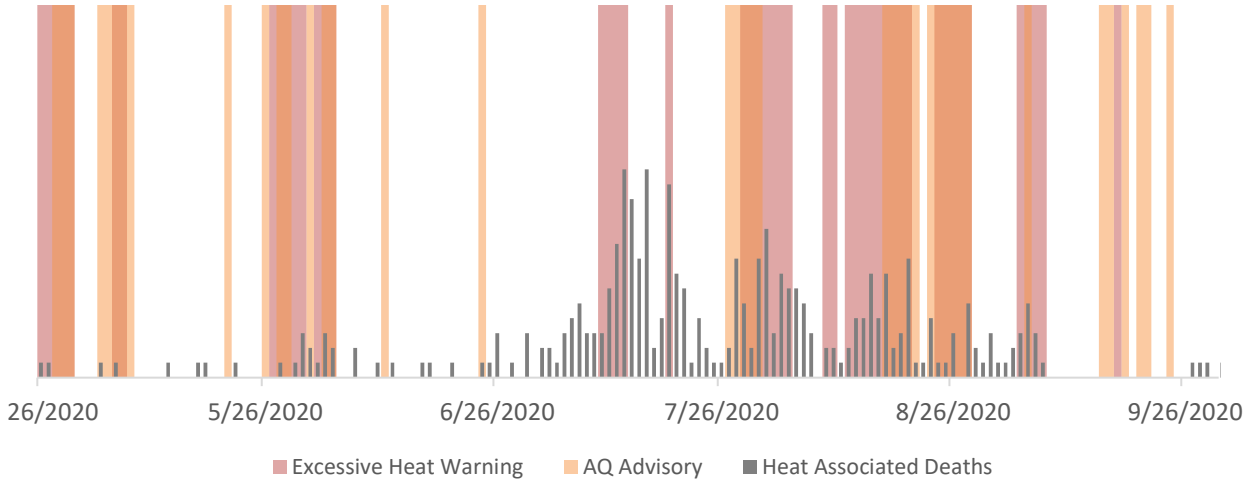
*Moderate Air Quality – Ozone (O_3) has reached or exceeded 55 part per billion

*Exceedance Air Quality - Ozone (O_3) has reached or exceeded 71 part per billion

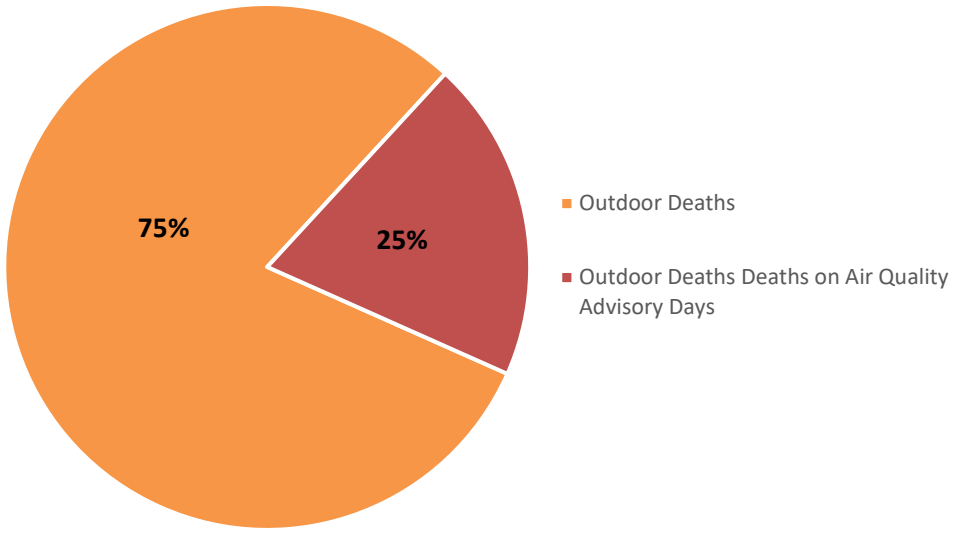
Figure 1. Seventy-five percent of deaths that occurred on an air quality exceedance day also occurred on an excessive heat warning day.



Graph 42. Of the 167 deaths that occured on heat advisory days, one third of them also occured on an AQI exceedance day.



Graph 43. Of the total number of outdoor deaths, 25% (67) of them occured on Air Quality Advisory days.

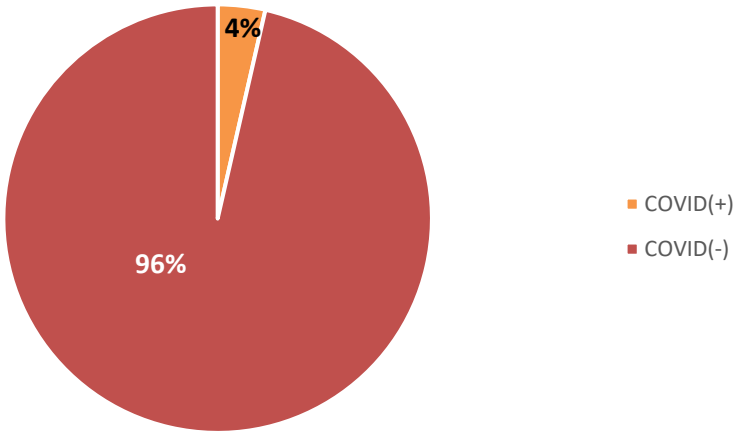


Pollution ratings found on Arizona Department of Environmental Quality

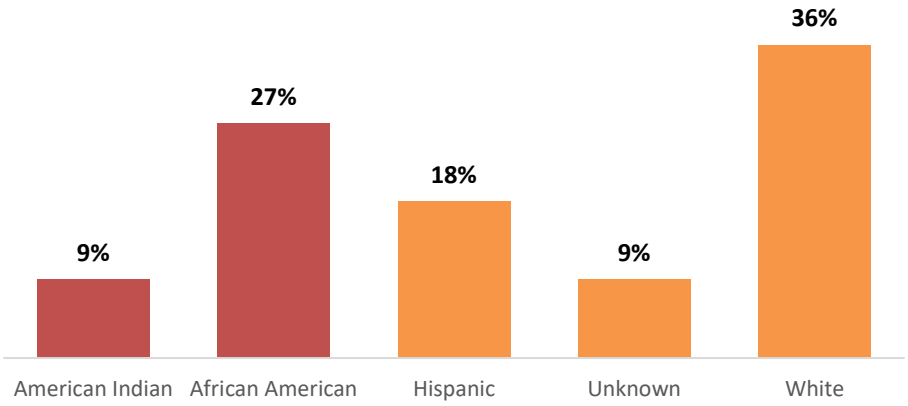
COVID-19 Heat-Associated Deaths

- Cases were verified for COVID-19 using MEDSIS, Arizona's Medical Electronic Disease Surveillance Intelligence System.

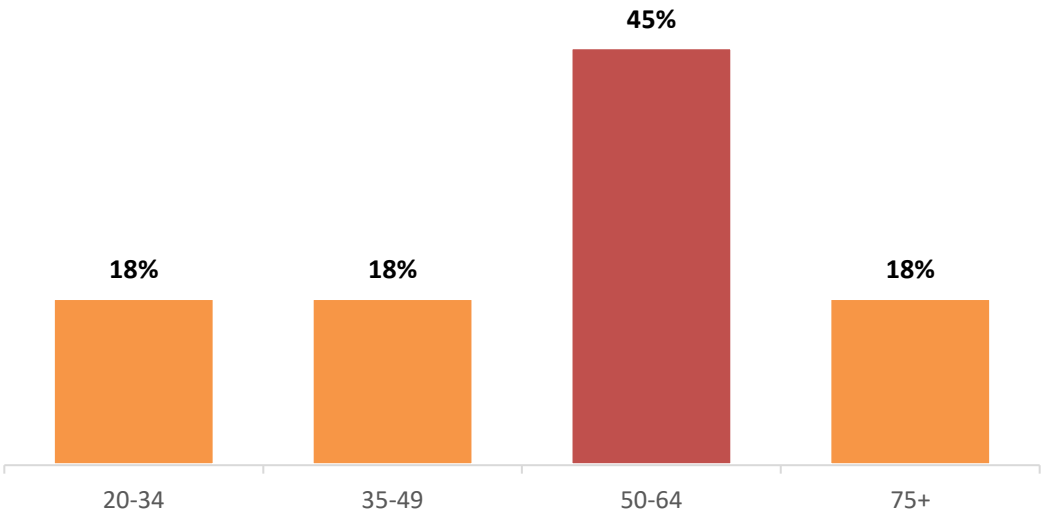
Graph 44. Four percent (11) of the total heat-associated deaths in 2020 had been positive for COVID-19 at time of death.



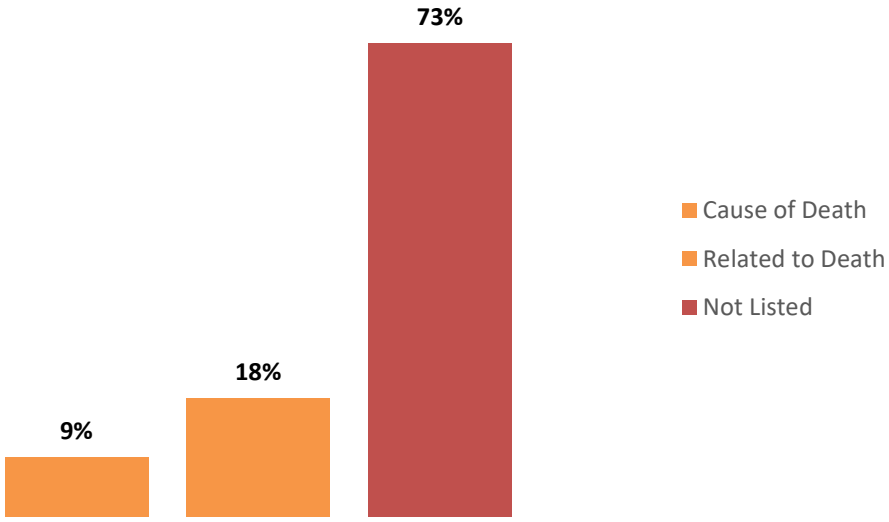
Graph 45. American Indians and African Americans were disproportionately represented among COVID-19 heat-associated deaths.



Graph 46. Forty-five percent of all COVID-19 heat-associated deaths were among those aged 50-64.



Graph 47. Twenty-seven percent of cases that were COVID-19 positive had COVID-19 listed as a cause of or relation to death.



* Cause of death and related to death indicates that COVID-19 was either directly involved in the sequence of conditions causing death or contributed to the death as indicated on the death certificate.

** Not listed means the individual was COVID-19 positive but COVID-19 was not directly involved in the sequence of conditions causing death or contributing to the death.

Conclusions

- There was an 62.3% increase in heat-associated deaths between 2019 and 2020.
- Twelve excessive heat warnings were issued in 2020 for a total of 48 days. On those days, 52% of all heat-associated deaths occurred. The average number of heat warnings for the past 5 years (2015-2019) is 5 lasting for a total of 17 days.
- This year had the earliest excessive heat warning on record on April 26th, 2020.
- The majority of Arizona residents who died from heat-associated deaths lived here for greater than 20 years.
- Males, African Americans, American Indians, and those ages 75+ have the highest rates of heat-associated death.
- Sixty-six percent of all heat-associated deaths occurred in those aged 35-64.
- Males had a 4x higher death rate than females per 100,000.
- The proportion of outdoor deaths compared to indoor deaths in 2020 is the highest it's been since 2011. Eighty-five percent of deaths in 2020 occurred outdoors.
- Phoenix had the highest number of heat-associated deaths compared to all other cities in Maricopa county.
- Sixty-one percent of heat-related injuries that happened outdoors occurred in an urban area.
- Sixty-nine percent of people who had A/C at the time of death reported having non-functioning A/C.
- Substance use was directly correlated with 58% of all heat deaths, 85% of which involved drugs only.

- Methamphetamine was a contributing factor or main cause of death in 35% of all heat-associated deaths.
- Fifty-three percent of heat-associated deaths occurred among the homeless population, nearly double the proportion in 2019.
- Eighty-one percent of all deaths occurred during daytime hours, most commonly during dusk.
- One quarter of all outdoor heat-associated deaths occurred on days that had an AQI advisory warning issued.
- Four percent (11) of all heat-associated deaths in 2020 tested positive for COVID-19.
- People aged 50-64 made up 45% of all COVID-19 positive heat-associated deaths.

Appendices

Appendix 1 - Background and Methodology

Background

In July 2005, Maricopa County (MC) experienced exceptionally high temperatures that contributed to 45 deaths, of which 35 occurred over nine consecutive days. Temperatures reached 116° F and three excessive heat warnings were issued during this month. After this event, the Maricopa County Department of Public Health (MCDPH) created a novel and effective approach for surveillance of heat-associated deaths in 2006 and has continued to use this system annually.

Methodology

Surveillance data is obtained from the following sources:

1. The Maricopa County Office of the Medical Examiner (OME) forwards suspected heat-related deaths to MCDPH and provides data including demographics, preliminary information regarding how the death occurred, and the circumstances of death. In the past, this information came solely as a weekly line list with limited information for each case. However, in February of 2012, MCDPH started receiving all preliminary reports of death (PRODs) from the OME. These reports provide expanded information daily and have changed the screening methods used by MCDPH staff to ensure that all potential heat-related deaths are documented.

2. The MCDPH Office of Vital Registration registers all Maricopa County death certificates in the Arizona Department of Health Services vital records database. The MCDPH Office of Epidemiology searches this database looking for causes of death associated with environmental heat. A Statistical Analysis Software (SAS) program looks for the key phrases and International Classification of Disease-10 (ICD-10) codes listed below.

Key Phrases
HEAT EXPOSURE
ENVIRON
EXHAUSTION

ICD 10 Code	Corresponding Definition
X30	Exposure to excessive natural heat
T67.X	Effects of heat and light
P810	Environmental hyperthermia of newborn

SUN
HEAT STRESS
HEAT STROKE
HYPERTHERMIA

3. Hospital and media reports can sometimes initiate a heat death investigation, for example, if a child is reportedly left in a hot car.

Once data are received, analysis of the information is required to identify only those deaths caused as a result of environmental heat. Environmental heat is heat generated by the climate (sun, humidity, etc.) rather than heat from man-made sources such as ovens or manufacturing equipment. Heat-associated deaths are categorized based on the classification criteria listed below:

Heat-caused (HC) deaths are those in which environmental heat was directly involved in the sequence of conditions causing deaths. These are deaths where environmental heat terms were indicated in ***Part I***[1] of the death certificate causes of death (diseases or conditions in the direct sequence causing death), for cause of death variables (*cod_a, cod_b, cod_c, or cod_d)*. County of death: Maricopa.

Heat-related (HR) deaths are those in which environmental heat contributed to the deaths but was not in the sequence of conditions causing these deaths. These are cases where environmental heat terms were mentioned in ***Part II***[2] of the death certificate causes of death (diseases and conditions contributing but not directly resulting in the death sequence), but not in any of the Part I death variables (*cod_a, cod_b, cod_c, or cod_d*). County of death: Maricopa.

For the purposes of this report, heat-caused and heat-related deaths are combined and referred to as "heat-associated deaths." Please note that most jurisdictions report only heat-caused deaths. This should be considered when comparing Maricopa County data with data from other locations.

Death certificate data, in combination with the OME notes, are used to produce the information that is contained in this report. Total case count, demographics, residency, drug/alcohol use, and years lived in Arizona are directly retrieved from death certificate data. Place of death location, indoor/outdoor occurrence, air conditioning use, and homelessness are retrieved based on explicit notations made in the death certificate and/or OME notes. For the purposes of this report,

reasons for not having a cooled environment at the time of death in indoor cases where an A/C unit was present were grouped into three categories: non-functioning, functioning but turned off, and no electricity. "Non-functioning" is defined as an A/C unit that was not operating properly, was broken, or could not be turned on despite the presence of electricity. Cases categorized as having a "functioning but turned off" A/C unit indicate that the unit worked properly but was the A/C was turned off for some reason at the time of the OME scene inspection. In cases where the unit could not be turned on due to a lack of electricity, regardless of whether it was functioning or non-functioning, were counted in the "no electricity" category.

Homelessness is defined as having an address on the death certificate that matches a homeless shelter, government agency, business, or an intersection. Cases are also classified as homeless if there is an indication on the death certificate. If the address is listed as unknown on the death certificate then an examination of the medical examiner's notes is made to determine if there is a reference to an address - if none, then the person is classified as homeless. If the address is listed as out of jurisdiction then time spent in Arizona, as provided by the death certificate, is taken into consideration.

Once classification is completed, the data are summarized for the production and dissemination of reports. Reports are generated weekly during the season and posted to the MCDPH website which can be found at: http://www.maricopa.gov/publichealth/Services/EPI/Reports/heat.aspx

[1] **Part I of the death certificate:** cod a – is the immediate cause (final disease or condition resulting in death) cod b, cod c, cod d – are sequentially listed conditions leading to the cause listed on cod a.

[2] **Part II of the death certificate:** Other significant conditions contributing to death but not resulting in the underlying cause given in Part I.

To receive additional data, please submit a data request form through the Maricopa County Public Health website here. A staff member from the Climate and Health team will contact you to discuss your request.

You may also contact the Climate and Health Team through email:

Vjollca Berisha: Vjollca.berisha@maricopa.gov

Aaron Gettel: Aaron.gettel@maricopa.gov

Tony Bishop: Tony.bishop@maricopa.gov

Jessica Whitney: Jessica.whitney@maricopa.gov

Appendix 2 – Tables

Table 1.

Heat-Associated Deaths by Year

Year	Number of deaths	Under Investigation
2001	21	0
2002	38	0
2003	49	0
2004	42	0
2005	75	0
2006	85	0
2007	51	0
2008	49	0
2009	74	0
2010	82	0
2011	106	0
2012	110	0
2013	75	0
2014	61	0
2015	84	0
2016	154	0
2017	179	0
2018	182	0
2019	199	0
2020	323	0

Table 2.

Heat-Associated Deaths by Year

Year	Heat-Caused	Heat-Related	Total
2006	58	27	85
2007	38	13	51
2008	32	17	49
2009	47	27	74
2010	48	34	82
2011	57	49	106
2012	63	47	110
2013	42	33	75
2014	33	28	61
2015	45	39	84
2016	88	66	154
2017	90	89	179
2018	119	63	182
2019	138	61	199
2020	213	110	323
TOTAL	1111	703	1814

Table 3.

Heat-Associated Deaths by Month and Classification, Maricopa County, 2020

	March	April	May	June	July	August	September	October	November	December	Total
Heat-Related	0	*	7	7	53	35	*	*	0	0	110
Heat-Caused	0	*	*	17	102	73	14	*	0	0	213
Total	0	*	11	24	155	108	19	*	0	0	323

Table 4.

Heat Associated Deaths by Year and Month

Years	Jan	Feb	March	April	May	June	July	August	Sept	October	November	December	Total
2006-2008					3	39	104	28	8	3			185
2009-2011	1		1	2	7	37	118	67	27	2			262
2012-2014			1	1	6	47	97	65	20	5	4		246
2015-2017			5	4	11	127	148	86	26	5	4	1	417
2018-2020				4	24	63	312	221	69	10	1		704

Table 5.

Heat Associated Deaths by Residency

	Maricopa County Resident	**Non-Maricopa County**	**Non-Arizona Resident**	**Total**	**Unknown**
Total (N=323)	273	26	17	316	7
% of Cases	86%	8%	5%		

Table 6.

Heat-Associated Deaths by Time Residing in Arizona*

Years in Arizona	Number of Deaths	% Deaths
<3 Years	13	7%
3-9 Years	29	16%
10-19 Years	24	13%
20+ Years	112	63%
Total	178	100%
Unknown	72	29%

Heat Associated deaths by Demographic

Table 7.

Total Deaths By Gender

Gender	N	%
Male	262	81%
Female	61	19%

Table 8.

Total Deaths by Gender and Age Group

Age Group	0-4	5-19	20-34	35-49	50-64	65-74	75+	Unknown	Total
Female	*	*	*	14	19	6	17	*	61
Male	*	*	29	79	99	28	26	*	262
Total	*	*	32	93	118	34	43	*	323
Percent	0.3%	0.3%	9.9%	28.8%	36.5%	10.5%	13.3%	0%	

Table 9.

Total Deaths By Race

Race	Heat-Associated Deaths	All Deaths (Incl Non-MC Res)
Asian/Pacific Islander	1%	*
American Indian	4%	13
African American	15%	48
Hispanic	20%	62
White	60%	190
Total	100%	317
Unknown		6

Heat Associated Death Rates

All populations based on US Census Bureau 2019 population counts.

Table 10.

Death Rates by Gender and Age

Gender	Male			Female		
Age Group	Deaths	Population	Rate	Deaths	Population	Rate
0-4	*	140990	0.0	*	135129	0.7
5-19	*	456832	0.2	*	438712	0.0
20-34	25	487518	5.1	*	467839	0.6
35-49	60	433254	13.8	11	435891	2.5
50-64	85	384623	22.1	19	408159	4.7
65-74	23	185041	12.4	6	217273	2.8
75+	23	128858	17.8	16	165295	9.7
TOTAL	217	2217116	9.8	56	2268298	2.5

Table 11.

Deaths Rate by Race

Race	% of all Heat-Associated Deaths	Rate per 100,000 MC residents	Population	All MCR Deaths
Asian/Pacific Islander	1%	2.03	196,671	*
American Indian	3%	9.15	76,504	7
African American	14%	15.71	248,228	39
Hispanic	20%	3.76	1,408,855	53
White	60%	6.77	2,437,462	165
Total	100%		4,485,414	268
Unknown	0%			*

Heat Associated Deaths By Place of Injury

Table 12.

Gender and Place of Injury

POI	Male	Male N	Female	Female N	Total
Indoor	10%	25	34.4%	21	46
Outdoor	90%	231	65.6%	40	271
Unknown		6		0	6
Total		256		61	323

*Unknowns not included in % calculations.

Table 13.

Place of Injury by Year

Year	Outdoor	Indoor	Outdoor	Indoor
2020	85%	15%	271	46
2019	76%	24%	152	47
2018	72%	28%	128	51
2017	60%	40%	108	71
2016	61%	39%	93	59
2015	61%	39%	51	33
2014	72%	28%	42	16
2013	59%	41%	44	30
2012	58%	42%	62	45
2011	46%	54%	47	56

Table 14.

Outdoor Place of Injury

Place of Injury (Outdoor)	N	%
Car	8	3%
Desert Area/Hiking Trail	39	14%
Residence	51	19%
Urban Area/Park	166	61%
Unknown	*	2%
Other	*	1%
Total	271	100%

Table 15.

Indoor Place of Injury

Place of Injury (Indoor)	N	%
Residence	*	7%
Trailer/RV	13	28%
House	25	54%
Apartment	*	9%
Condo	*	2%
Total	46	100%

Table 16.

Welfare Check	Indoor Deaths	Outdoor Deaths
Yes	23	14
No	23	257
Total	46	271
Welfare Check	50%	5.2%
No Welfare Check	50%	94.8%

Air Conditioning Use for Indoor Injury*

Table 17.

A/C Status

A/C Present (Indoor)	Number of Cases	Percent
A/C Present	37	82%
A/C Not Present	8	18%
Total (not including unknowns)	45	
Unknown	*	

Table 18.

A/C Reason

Reasons for not having properly running AC*	N
Non-Functioning	25
Functioning but Not In Use	11
Total	36
Other/Unknown	*

Substance Use among Heat-Associated Deaths

Table 19.

Substance use

Substance use status	N	%
Substance Use	186	58%
No Substance Use	137	42%

Table 20.

Substance Type

Substance	N	%
Drugs only	158	85%
Alcohol only	19	10%
Drugs and alcohol	9	5%
TOTAL	186	

Table 21.

Type of Drug used (Cause or Related to Death)

Drug Name	# of Deaths	Cause of Death	Related to Death
Multiple	43	33	10
Methamphetamine	112	89	23
Cocaine	*	*	*
Fentanyl	*	*	*
Total	158	125	33
Percentages	100%	79%	21%

Table 22.

Substance Use by Year

Year	Alcohol	Percent	Drugs	Percent
2006	14	16%	20	24%
2007	7	14%	*	6%
2008	*	10%	8	16%
2009	6	8%	7	9%
2010	13	16%	17	21%
2011	14	13%	10	9%
2012	14	13%	12	11%
2013	14	19%	13	17%
2014	6	10%	14	23%
2015	10	12%	15	18%
2016	25	16%	36	23%
2017	17	9%	57	32%
2018	30	16%	68	37%
2019	25	13%	84	42%
2020	19	6%	158	49%

Living Situation among Heat-Associated Deaths

Table 23.

Living Situation Type

Living Situation	N	%
Homeless	172	53%
Living Independently	68	21%
Co-Habitating/Roommate	41	13%
Unknown (Non-Homeless)	7	2%
Unknown	35	11%
Total	323	100%

Table 24.

Living Situation by Year

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Homeless	32	6	*	21	22	20	20	20	7	8	54	57	61	66	172
Non-Homeless	53	45	46	53	60	86	90	55	54	76	100	122	121	133	116
Percent Homeless	38%	12%	6%	28%	27%	19%	18%	27%	11%	10%	35%	32%	34%	33%	60%

Education Level Among Heat Associated Deaths

Table 25.

Education

Education Level	# of Deaths	% of Total Deaths
8th Grade or less	19	8%
9th-12th (No Diploma)	44	19%
High School	105	44%
Some College	35	15%
Associate	7	3%
Bachelors	19	8%
Masters	*	2%
PhD	*	1%
Total	237	

Heat Associated Deaths by Time

Table 26.

Time of Day (General)

	Number of Deaths
Daytime	260
Nighttime	63

Table 27.

Time of Day (Specific)

Daytimes Deaths	# of Deaths
Dawn (5:30a-8a)	23
Early Morning (8-10a)	27
Late Morning (10a-12p)	49
Early Afternoon (12-2p)	36
Mid Afternoon (2-4p)	50
Dusk (4-7:30p)	75

Heat Associated Deaths and COVID-19

Table 28.

Total COVID-19 Deaths

COVID(+)	COVID(-)	Unknown
11	296	*

Table 29.

COVID-19 and Gender

Gender	COVID +	%
Male	10	91%
Female	*	9%
Total	11	100%

Table 30.

COVID-19 and Race

Race	COVID +	%
American Indian	*	9%
African American	*	27%
Hispanic	*	18%
Unknown	*	9%
White	*	36%
Total	11	100%

Table 31.

COVID-19 and Age

Age	COVID +	%
20-34	*	18%
35-49	*	18%
50-64	*	45%
75+	*	18%
Total	11	100%

Table 32.

COVID-19 Cause or Related to Death

COD/CDC	COVID +	%
Cause of Death	*	9%
Related to Death	*	18%
Not Listed	8	73%

Appendix 3 – Profiles

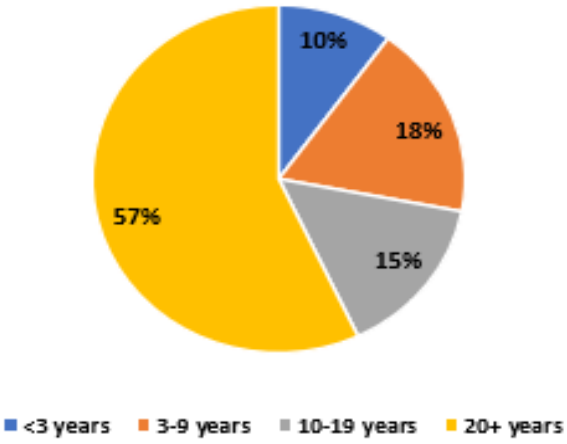
Substance Use Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

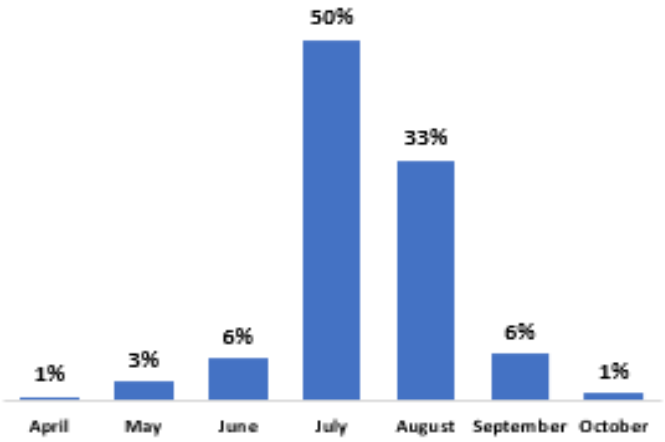
323 heat-associated deaths from 2020

58% (186) of heat-associated deaths involved substance use.

57% had lived in Arizona for **20 years or more**.



83% of heat deaths occurred in July and August.



Demographics

Of substance use heat deaths

93% were Male

82% were 35-64 years old

41% were of a minority race.

10% of deaths involved alcohol

85% of deaths involved drug use

82% were homeless

*Minority race includes the following races: Hispanic, American Indian, Asian/Pacific Islander, and African American.

- 7 (4%) of Injuries Occurred **Indoor:**
  - 1 House
  - 4 Mobile
  - 1 Residence
  - 1 Apartment

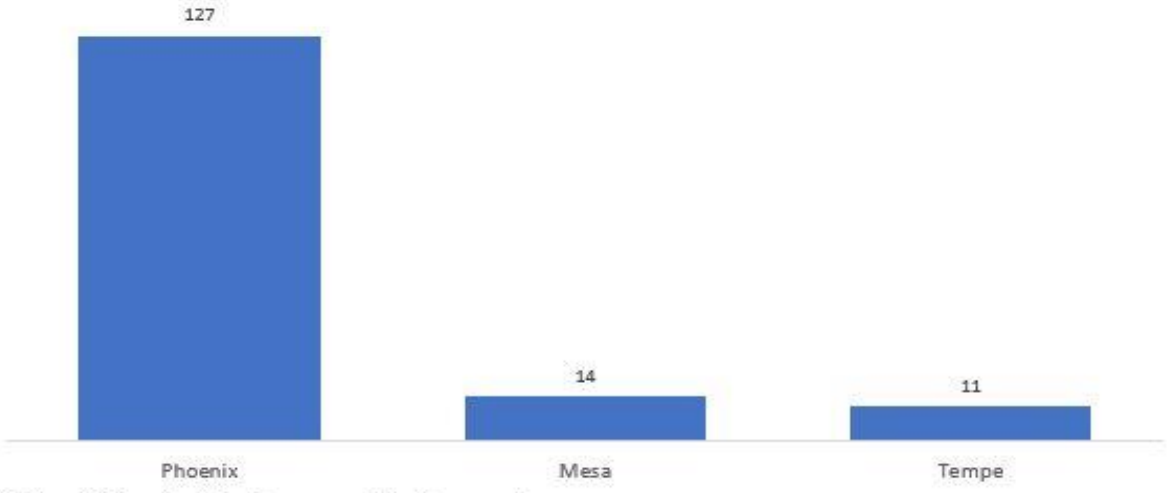
- 174 (94%) of Injuries Occurred **Outdoor:**
  - 5 Car
  - 21 Desert Area
  - 21 Residence
  - 123 Urban Area
  - 4 Unknown

6 heat-associated deaths involving substance use were COVID-19 positive. (3%)

Place of Death:

- 71: Indoor (38%)
- 115: Outdoor (62%)

Substance Use Heat-Associated Deaths by City



*Cities with less than 5 deaths were excluded from graph.

More information at Heataz.org

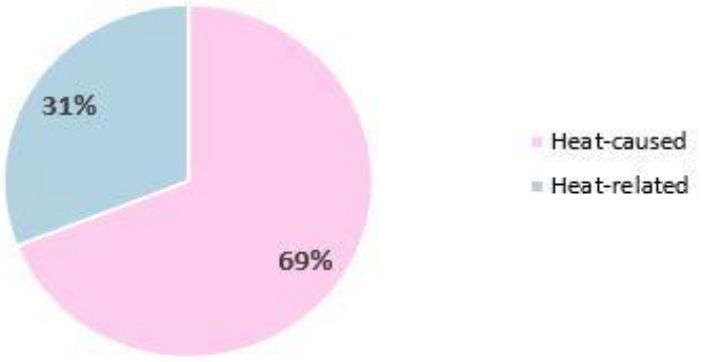
Heat-Associated Deaths Among 50-64 Year Olds, Maricopa County

Maricopa County Public Health
WeArePublicHealth.org

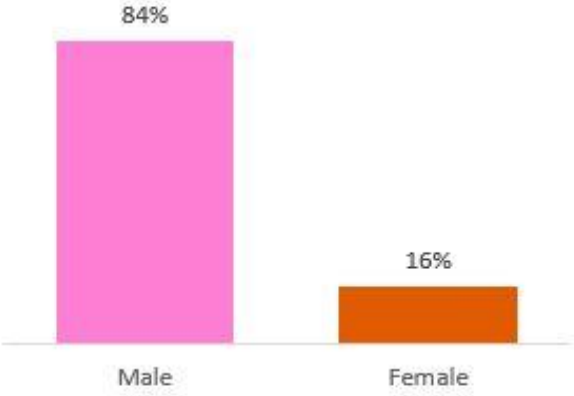
323 heat-associated deaths in 2020

37% (118) of heat-associated deaths occurred among 50-64 year olds.

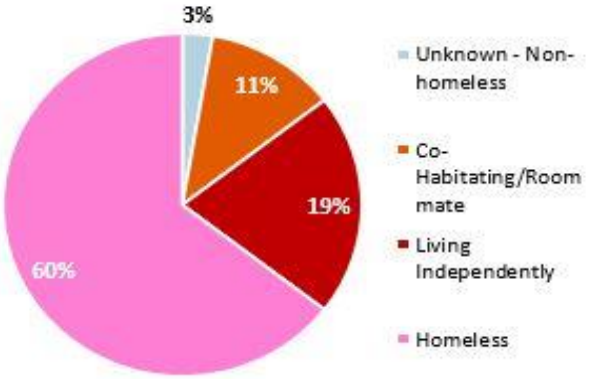
69% of Heat-Associated Deaths were Heat-Caused.



The majority of heat deaths were among males.

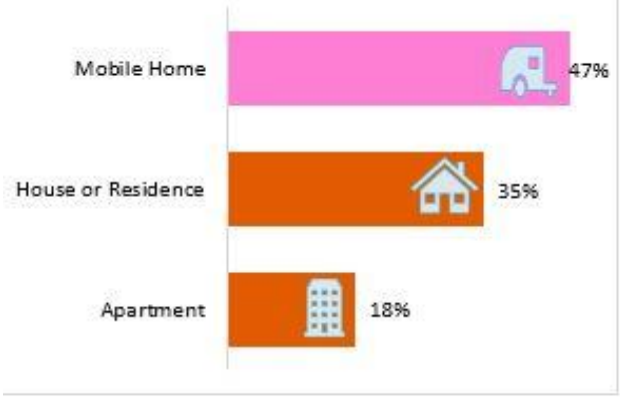


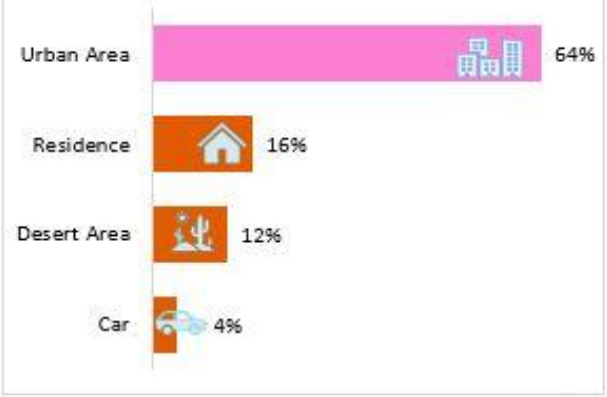
60% of heat deaths were homeless.

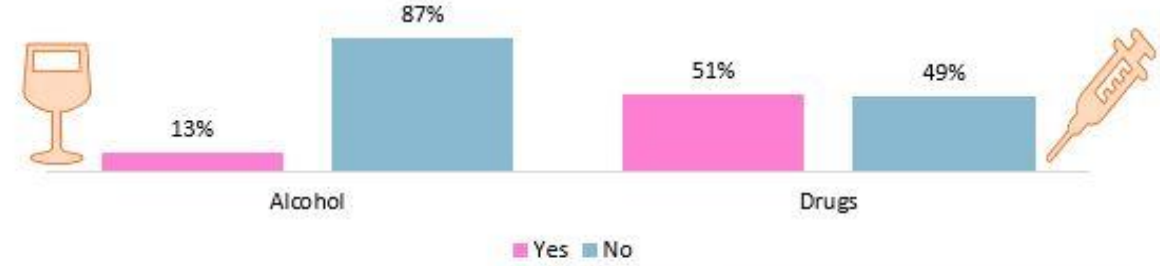


Place of Death:

- 55% had an outdoor place of death
- 45% had an indoor place of death







4% of heat deaths COVID-19 positive.

10% of heat deaths were discovered during a welfare-check.

Youth Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

323 heat-associated deaths in 2020

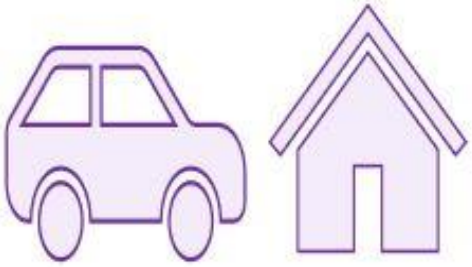
1% of heat-associated deaths occurred among youth.

100% of heat deaths were heat-caused.

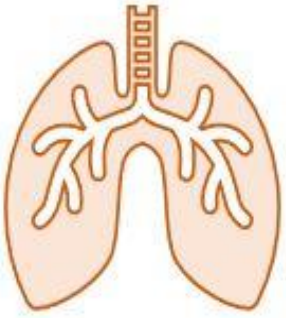
100% of heat-associated deaths had an outdoor place of injury.

50% occurred in a car

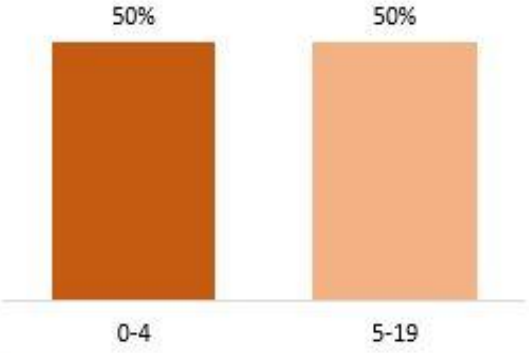
50% occurred in a residential area



0% of heat deaths were COVID-19 positive.



50% of youth heat-associated deaths were in the age group 0-4; the other 50% were in the age group 5-19.



100% of heat-associated deaths had an outdoor place of death.

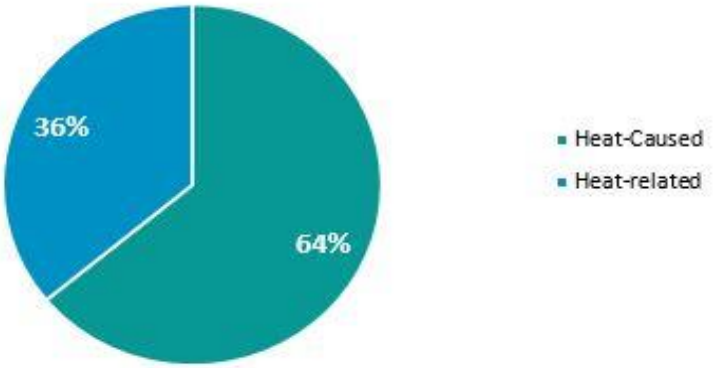
Female Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

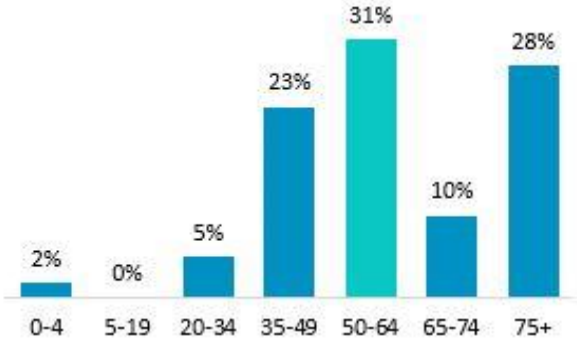
323 heat-associated deaths in 2020

19% (61) of heat-associated deaths occurred among females.

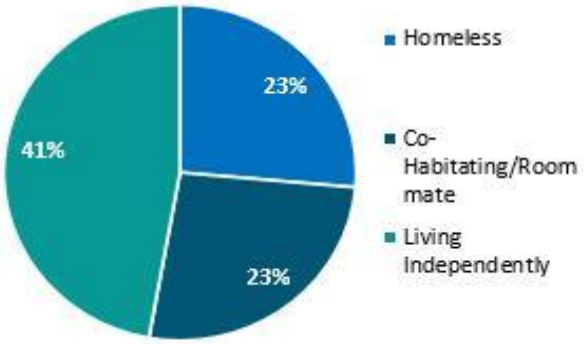
64% of Heat-Associated Deaths were Heat-Caused.



50-64 was the most common age group for Heat Deaths.

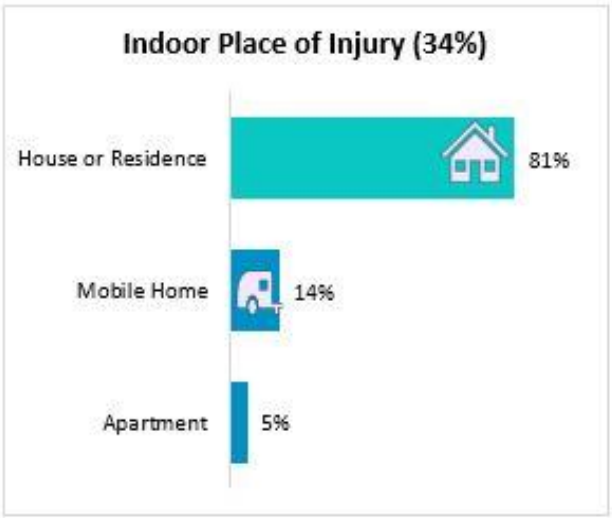


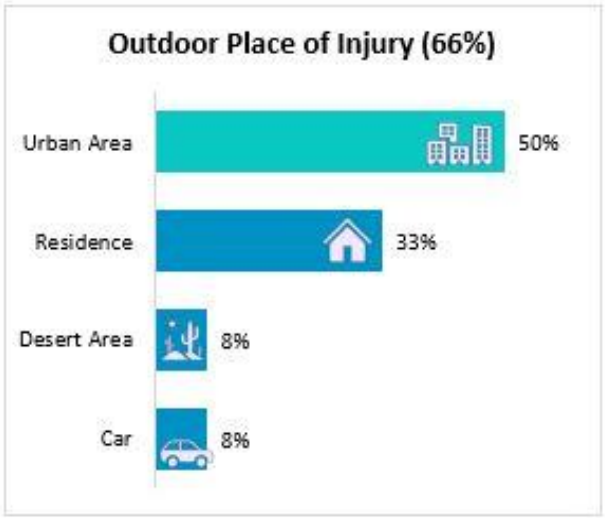
41% of Heat Deaths were Living Independetly.

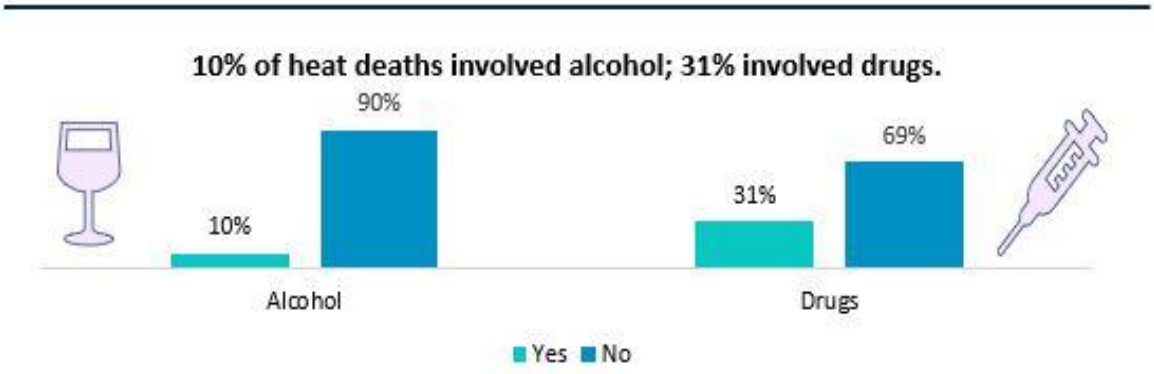


Place of Death:

- 39% had an outdoor place of death
- 61% had an indoor place of death







2% of heat deaths COVID-19 positive.

23% of heat deaths were discovered during a welfare-check.

Indoor Heat-Associated Injuries, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

323 heat-associated deaths in 2020

14% (46) of heat-associated injuries occurred indoors.

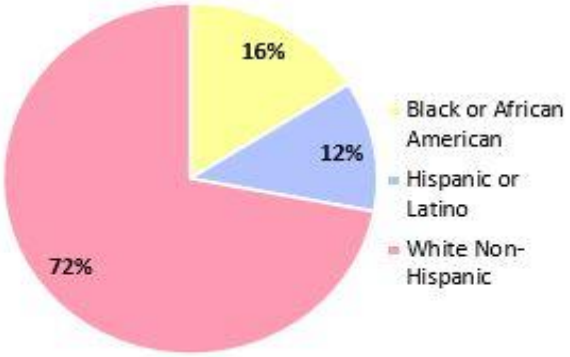
54% of indoor heat-associated injuries occurred among males.

46% of indoor heat-associated injuries occurred among females.

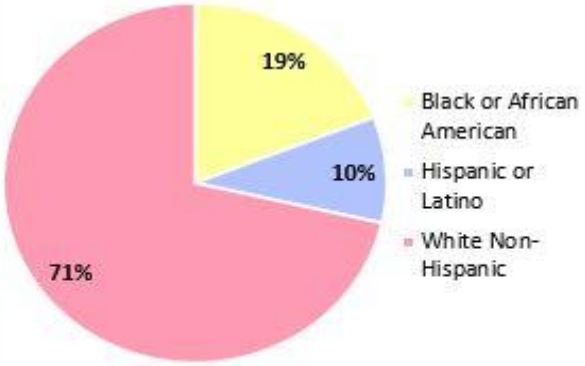
38% of indoor heat-associated injuries occurred in males aged 75+

43% of indoor heat-associated injuries occurred in females aged 75+

72% of male indoor injuries occurred among people who identify as white.



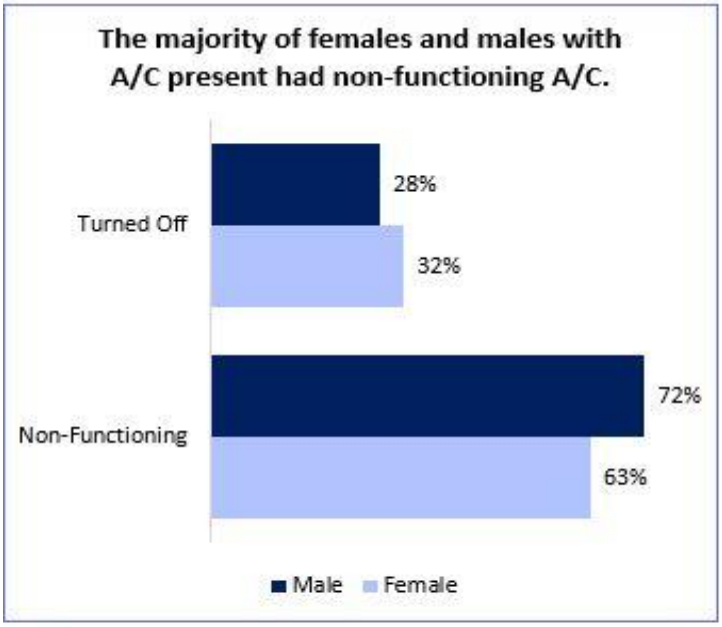
62% of female indoor injuries occurred among people who identify as white.

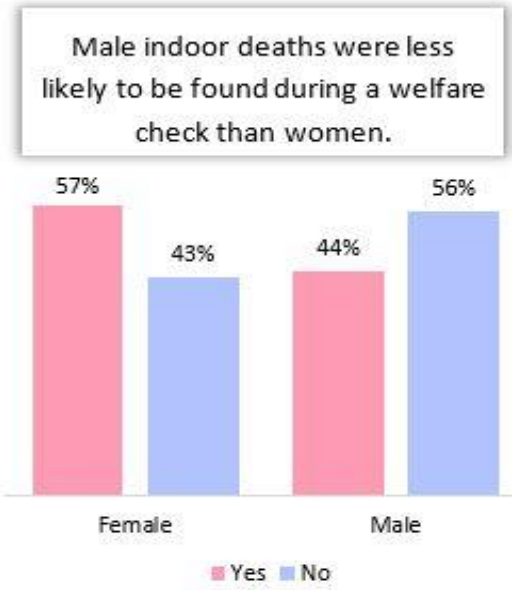


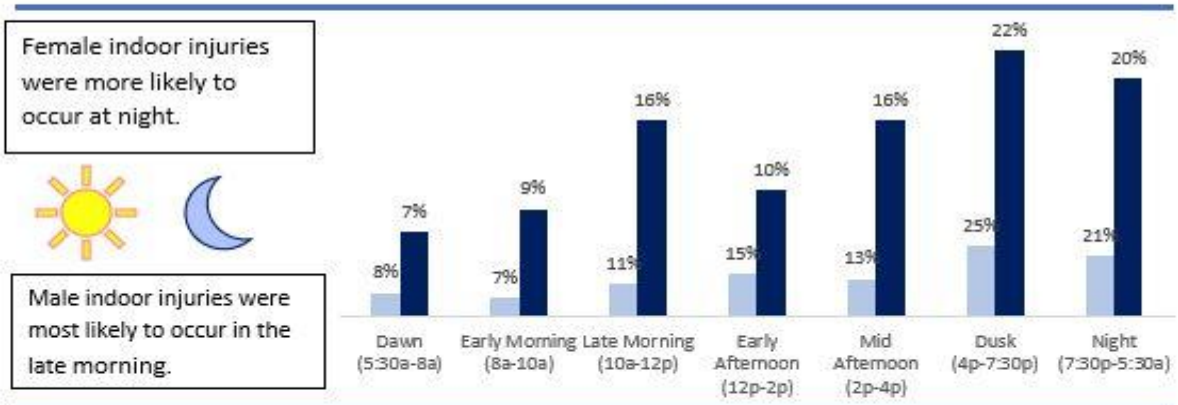
24% of male indoor injuries did not have A/C present at the time of death.

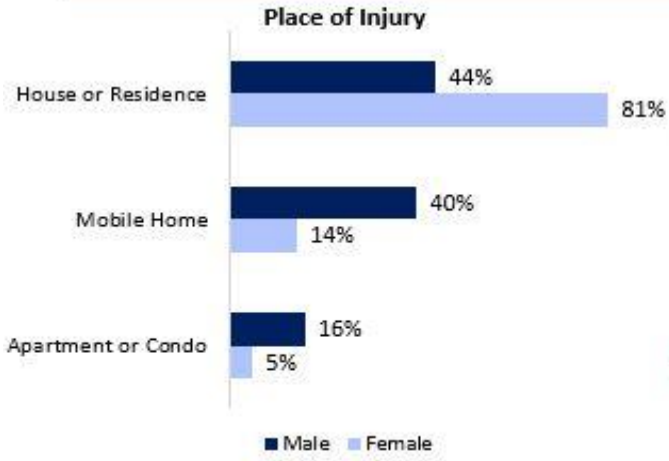
10% of female indoor injuries did not have A/C present at the time of death.

More information at Heataz.org









42% of men experienced a heat-associated injury in a trailer or mobile home.

76% of women experienced a heat-associated injury in a house.

Outdoor Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

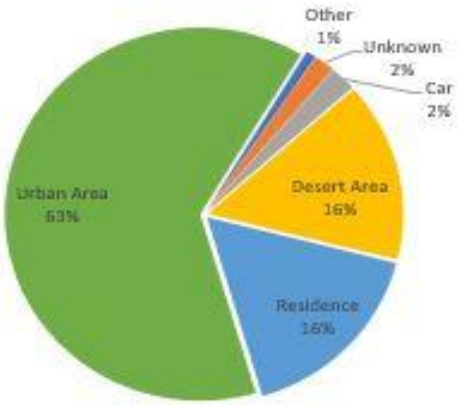
323 heat-associated deaths in 2020

83% (271) of heat-associated injuries occurred outdoors.

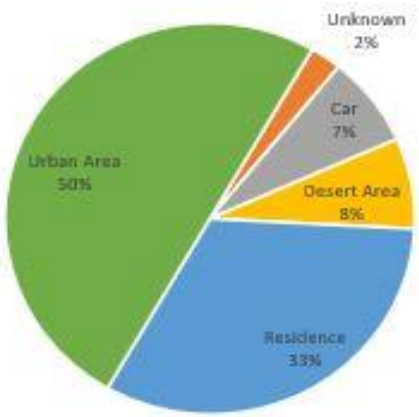
85% of outdoor heat-associated injuries occurred among males.

15% of outdoor heat-associated injuries occurred among females.

63% of male heat-associated deaths occurred in an Urban Area.



50% of female heat-associated deaths occurred in an Urban Area.



54% of male heat-associated deaths were 50+ years and older

41% of male heat-associated deaths were of a racial minority group

81% were Maricopa County Residents

58% of female heat-associated deaths were 35-64 years old

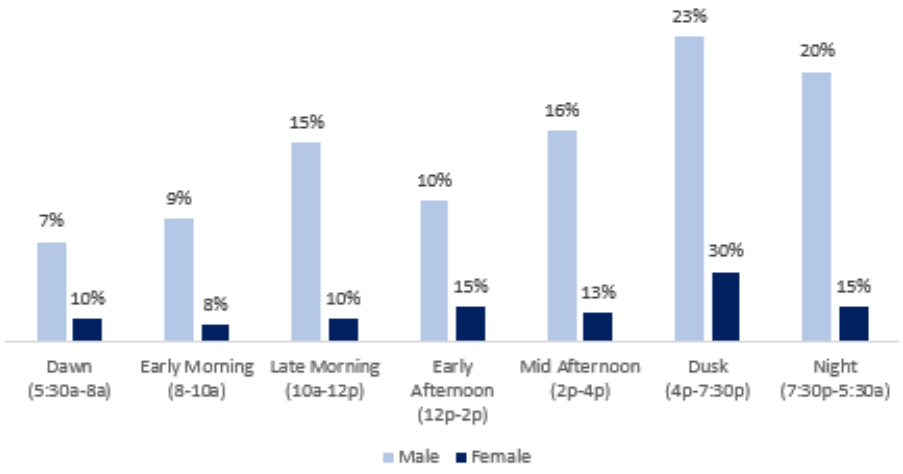
38% of female heat-associated deaths were of a racial minority group

88% were Maricopa County Residents

*Minority race includes the following races: Hispanic, American Indian, Asian/Pacific Islander, and African American.

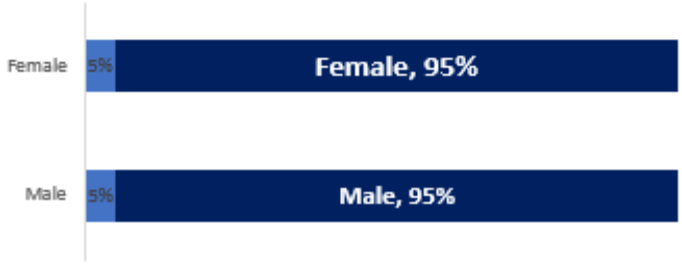
More than **50%** of female outdoor deaths happened in Phoenix, whereas Mesa, Tempe, and Phoenix were the top 3 cities that male outdoor deaths occurred.

Female, Phoenix, 22



More outdoor deaths happened between 4p and 7:30p than any other time of day in both genders.

Ninety-five percent of male and female outdoor deaths were not found during a welfare check.



100% of COVID-19 positive heat deaths with a known place of injury occurred outdoors.

Mobile Homes: Heat-Associated Deaths, Maricopa County 2020

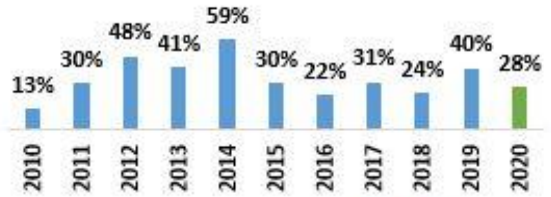
Maricopa County Public Health
WeArePublicHealth.org

323 heat-associated deaths in 2020

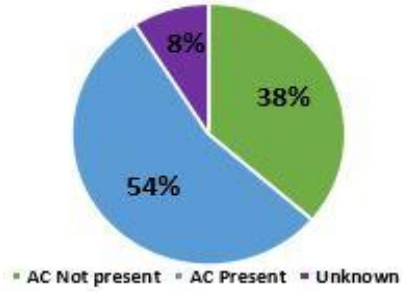
14% (46) of heat-associated injuries occurred indoors.

28% (13) of **indoor injuries** occurred in mobile homes.

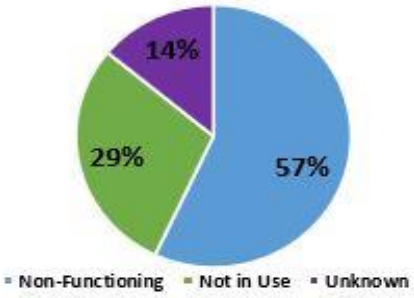
In 2020, 28% of indoor injuries occurred in mobile homes.



Of the injuries that occurred in mobile homes, **54%** had an AC unit present.



Of those present, **57%** were non-functioning and **29%** were not in use.



Demographics

Of deaths occurred in mobile homes

77% were Male

100% were 50+ years and older

85% were living independently

77% were white

31% involved substance use (drugs and/or alcohol)

More information at Heataz.org

Cars: Heat-Associated Deaths, Maricopa County 2020

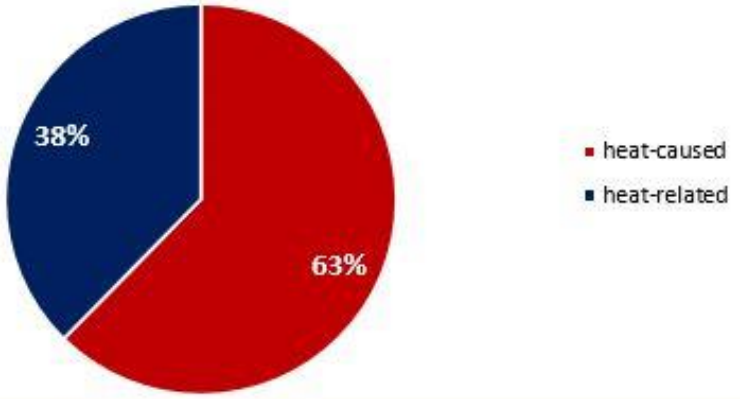
Maricopa County Public Health
WeArePublicHealth.org

323 heat-associated deaths in 2020

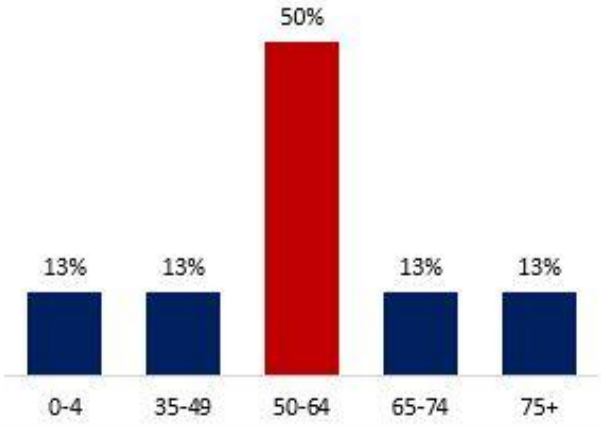
271 heat-associated deaths with an outdoor place of injury in 2020

2% (8) of heat-associated deaths had car listed as the place of injury.

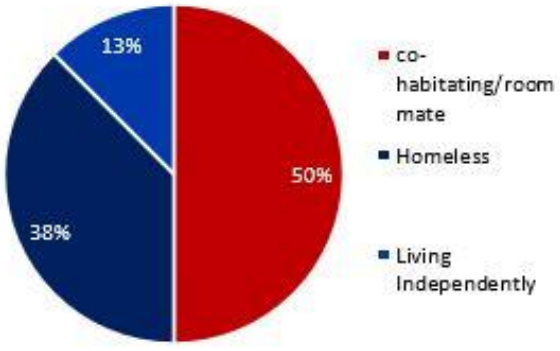
63% of deaths were heat-caused.



50-64 was the most common age group for heat deaths.



50% of cases were co-habitating or had a roommate.



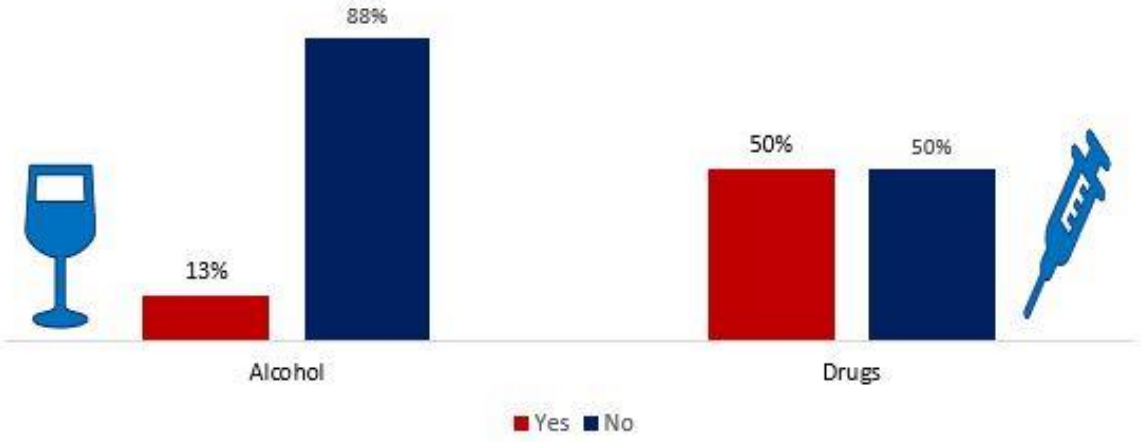
63% of cases were male.

38% of cases were female.

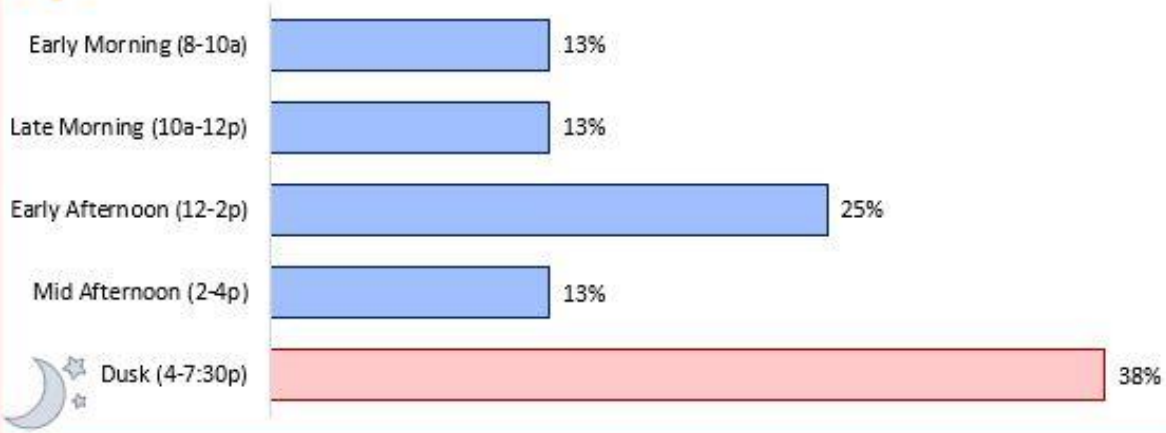
13%

of cases discovered during a welfare check

13% of cases involved alcohol; 50% involved drugs.



Most heat deaths occurred during the early afternoon (25%) or dusk (38%).



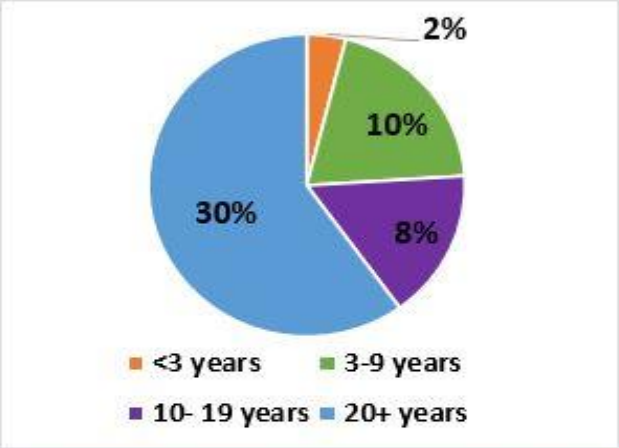
Homeless Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

323 heat associated deaths from 2020

53% (172) are **homeless** heat-associated deaths.

30% of homeless deaths lived in Arizona for **20 years or more**



4% of heat-associated deaths were discovered during a welfare check

9 heat deaths were COVID-19 positive (6%)

Demographics

Of homeless heat deaths

8% were Female

78% were 35-64 years old

42% were of a minority race.

9% of deaths involved alcohol

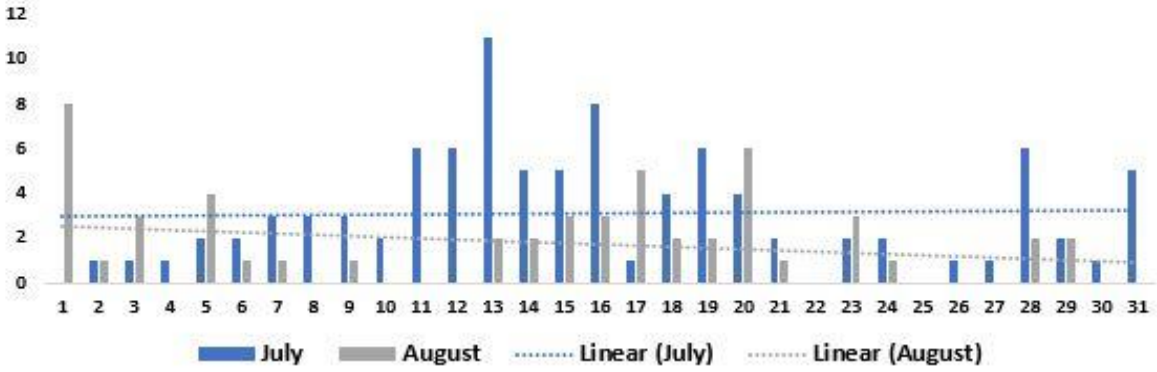
72% of deaths involved drugs

77% were injured in an urban area

More information at Heataz.org

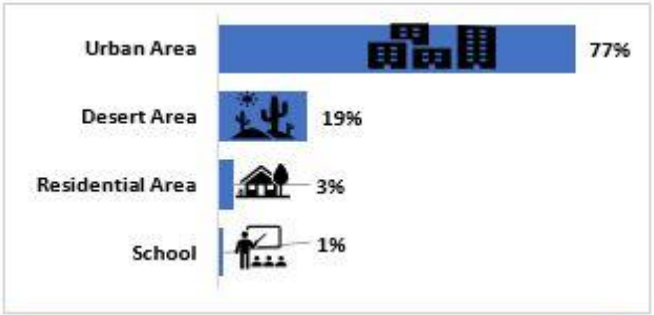
*Minority race includes the following races: Hispanic, American Indian, Asian/Pacific Islander, and African American.

Homeless Deaths by Day- July and August



- **76 deaths in 20 consecutive days occurred from July 2nd and 21st compared to August with only 26 deaths in 9 consecutive days from the 13th to the 21st.**

120 (70%) of **Deaths** Occurred **Outdoor:**



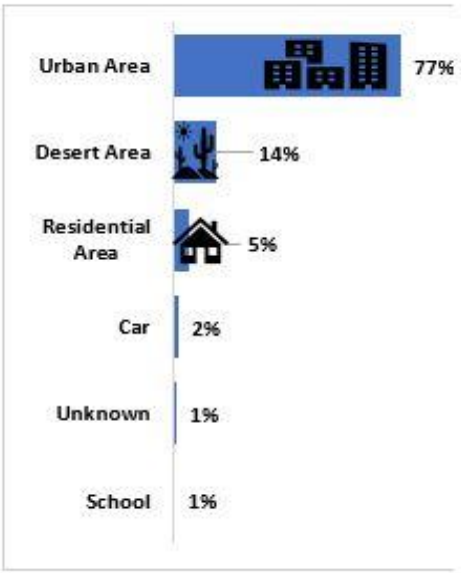
- **47 (28%)** of **Deaths** Occurred **Indoor** in **Hospitals** (46 Hospital Deaths and 1 Care Facilities) **after being injured in an OUTDOOR area**

- **1 (1%)** of Death Occurred **Indoors** in a Hospital after being **injured INDOOR** in a **Residential Area with no A/C present**

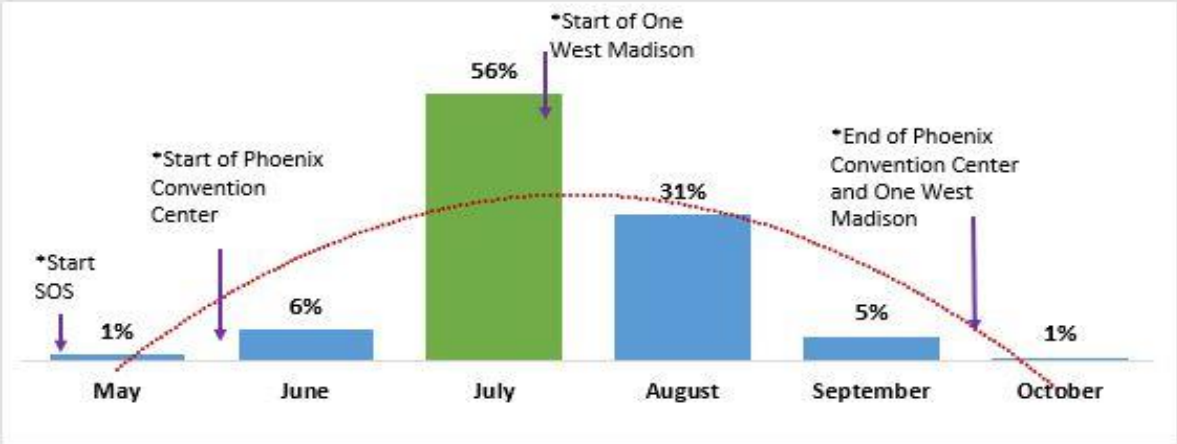
Place of Injury:

- 167: Outdoor (97%)
- 1: Indoor (1%)
- 4: Unknown (2%)

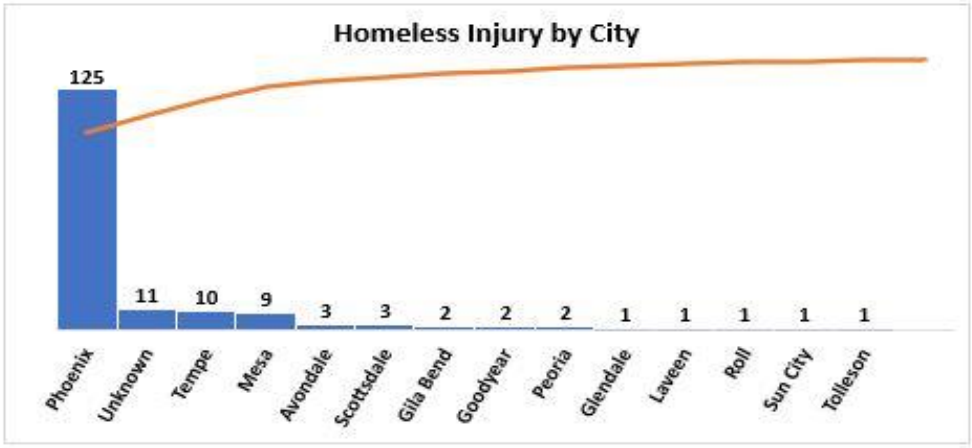
Outdoor Place of Injury



The **majority** of homeless deaths occur during the **summer** months.



*In 2020, Phoenix opened different locations for homeless populations to stay. The *Safe Outdoor Space (SOS)* opened April 20, 2020 and plans to close June 30, 2021. At this location, homeless persons can reserve and stay in a tent day and night. The *Phoenix Convention Center (PCC)* opened May 24, 2020 and closed September 30, 2020. The PCC was only open during the day. A vacant County-owned building at One West Madison was opened July 9, 2020 until September 30, 2020 and was open for night-time relief only. These places were opened temporarily to assist the homeless populations that could not get a room in the shelters.



Injury that Occurred Outdoors (167)		Hospital Death (Indoor) (47)
Residential Area	9	4
Urban Area	132	40
Desert Area	24	1
Unknown	2	2

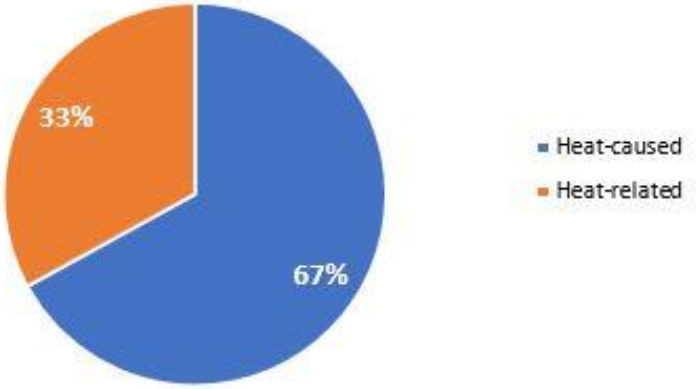
African American Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

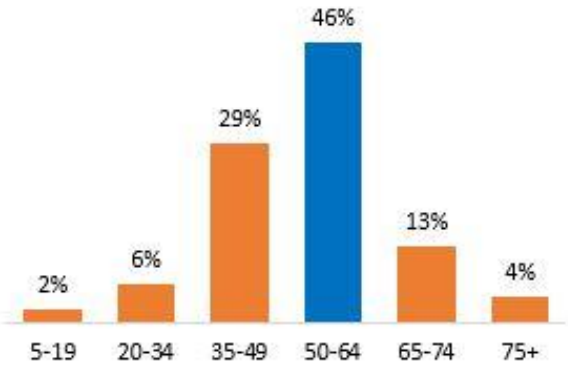
323 heat-associated deaths in 2020

15% (48) of heat-associated deaths occurred among African Americans.

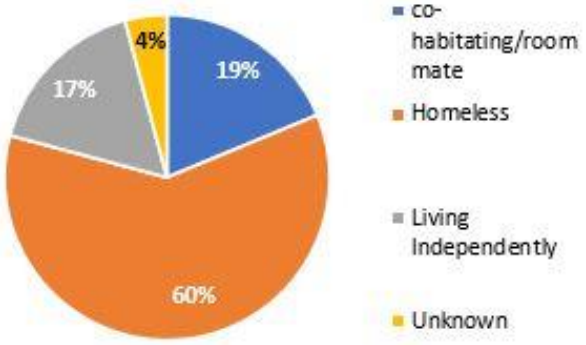
67% of Heat-Associated Deaths were Heat-caused.



50-64 was the most common age group for Heat Deaths.

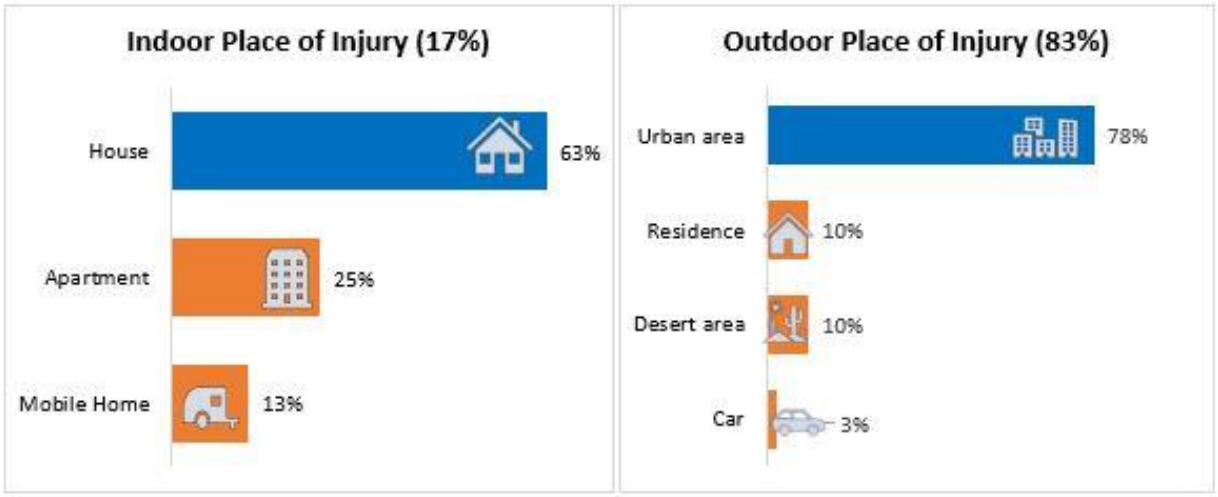


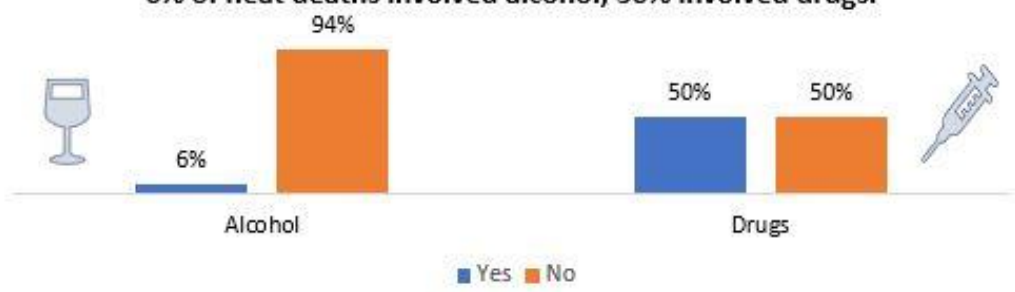
60% of Heat Deaths were Homeless.



Place of Death:

- 50% had an outdoor place of death
- 50% had an indoor place of death





6% of heat deaths were COVID-19 positive.

15% of heat deaths were discovered during a welfare-check.

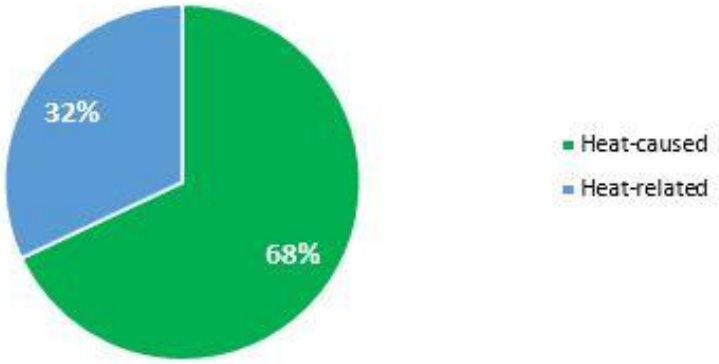
Hispanic Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

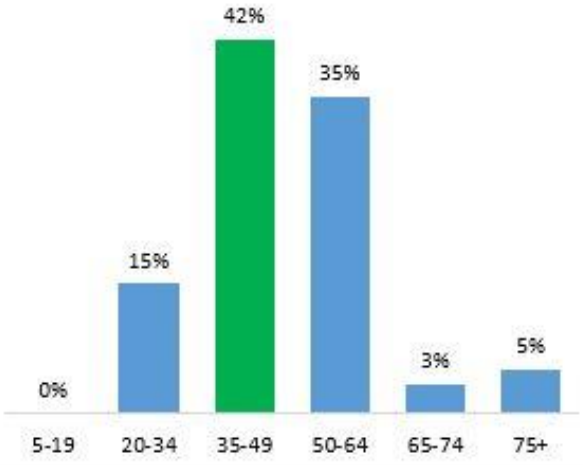
323 heat-associated deaths in 2020

19% (62) of heat-associated deaths occurred among Hispanics.

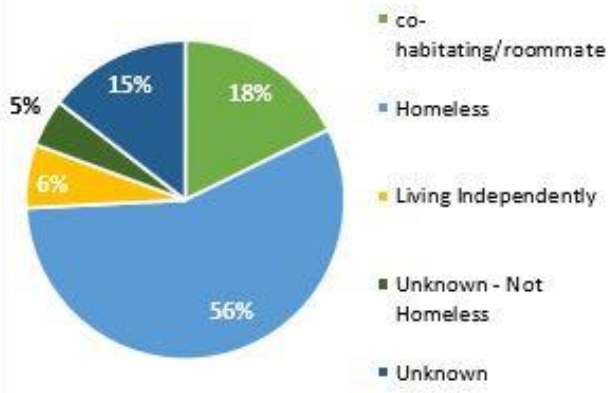
68% of Heat-Associated Deaths were Heat-Caused.



35-49 was the most common age group for heat deaths.

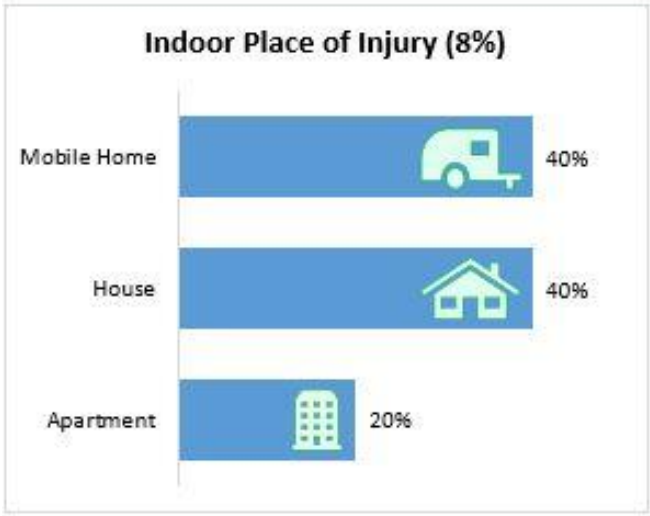


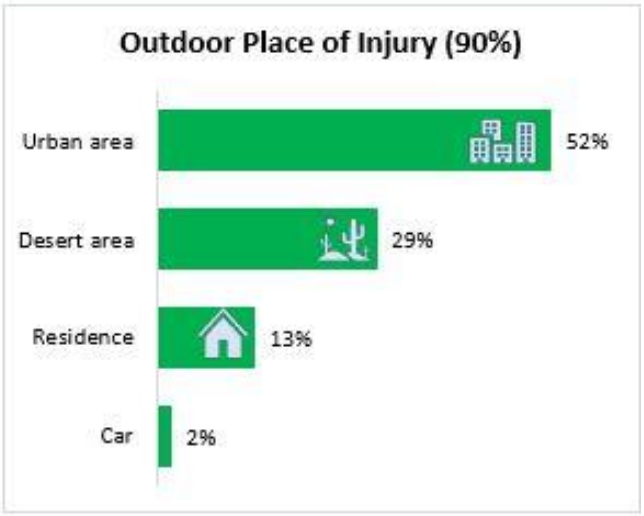
56% of heat deaths were homeless.

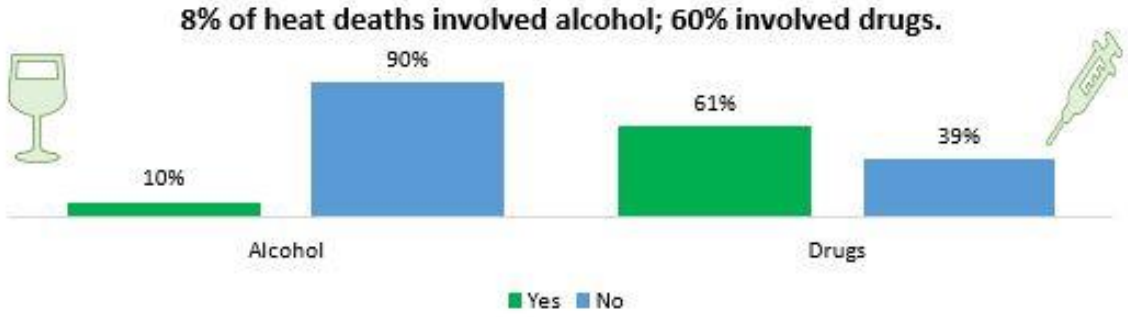


Place of Death:

- 60% had an outdoor place of death
- 40% had an indoor place of death







3% of heat deaths were COVID-19 positive.

5% of heat deaths were discovered during a welfare-check.

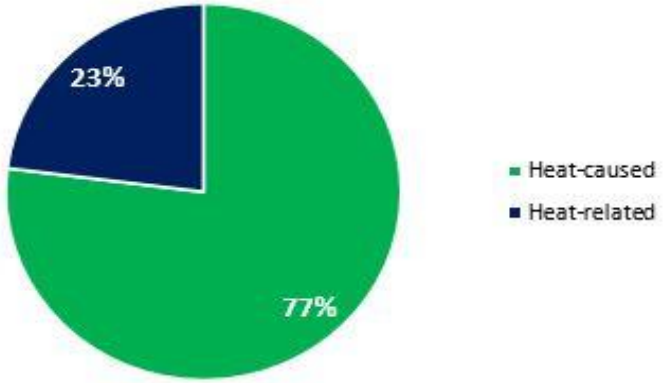
American Indian Heat-Associated Deaths, Maricopa County 2020

Maricopa County Public Health
WeArePublicHealth.org

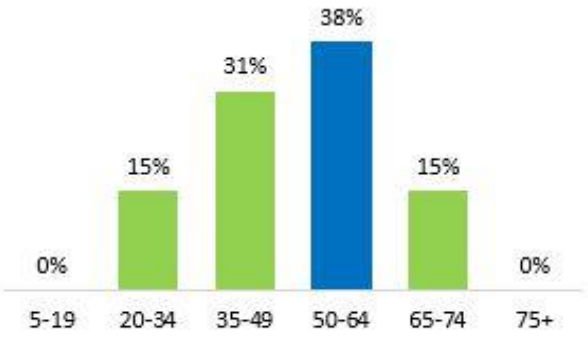
323 heat-associated deaths in 2020

4% (13) of heat-associated deaths occurred among American Indians.

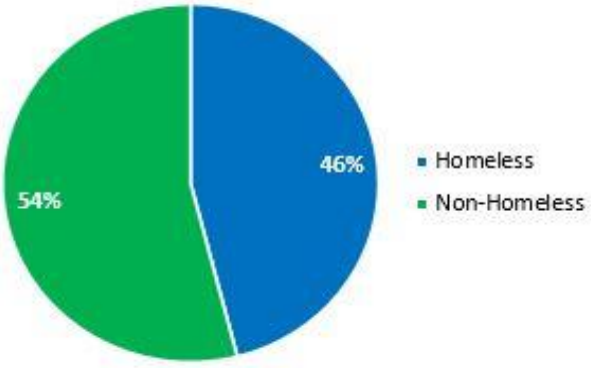
77% of Heat-Associated Deaths were Heat-caused.



50-64 was the most common age group for Heat Deaths.



46% of Heat Deaths were Homeless.

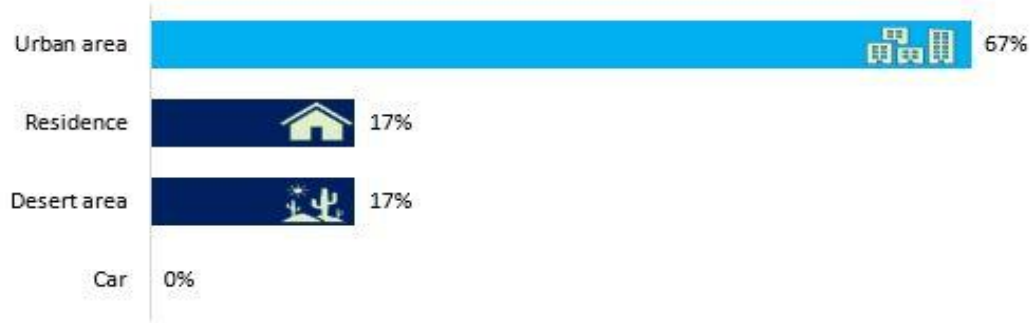


Place of Death:

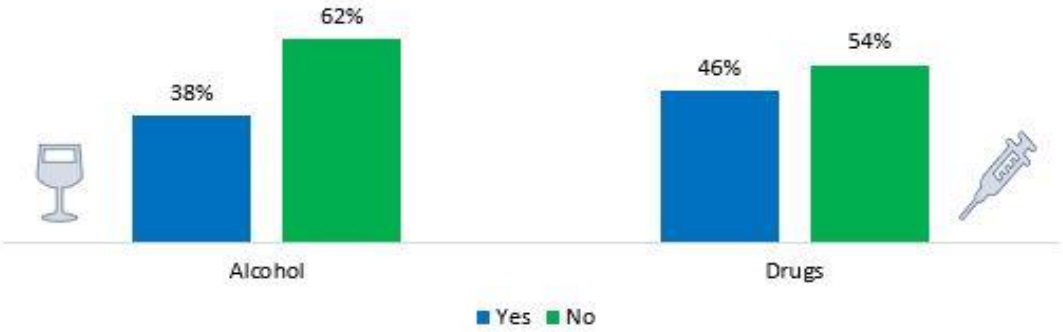
- 38% had an outdoor place of death
- 62% had an indoor place of death

Place of Injury	
Indoor POI	0%
Outdoor POI	92%
Car	0%
Desert area	17%
Residence	17%
Urban area	67%

Outdoor Place of Injury



38% of heat deaths involved alcohol; 46% involved drugs.



8% of heat deaths were COVID-19 positive.

NO AI heat-associated deaths were discovered during a welfare-check.